# WATER WORKS & SEWERAGE

A GILLETTE ABP ABC PUBLICATION

Vol. 86, No. 12 DECEMBER, 1939 L. H. Enslow Editor



The PITTSBURGH IMO METER . . .

IT'S ACCURATE

IT'S DURABLE

IT'S QUIET

Because it is built to specifications which guarantee an accuracy of 98% at 1/4 g.p.m. and 90% at 1/12 g.p.m., the Pittsburgh IMO Water Meter accurately measures those flows that either escape measurement entirely, or are only partially recorded by conventional meters. And what is even more important, this remarkable accuracy is sustained. Numerous tests show that even after several million gallons have been measured, Pittsburgh IMO Meters measure slightly better on the low flows than when first put into service, and that their accuracy does not change at rates of flow above 1 g.p.m.

Not only do Pittsburgh IMO Meters increase revenue by accurate measurement, but their maintenance costs are unusually low. The unique design of the measuring chamber and its semi-floating rotors increases the life of the working parts as compared with conventional meters and insures longer, trouble-free service.

The smoothly turning rotors, precision cut to mesh perfectly, revolve with a semi-floating action as the water flows through the measuring chamber in a straight line. For this reason the Pittsburgh IMO Meter can never become noisy; there can be no "clicking" noise to annoy your consumers. Write for the complete story in Bulletin W-529.

IMO

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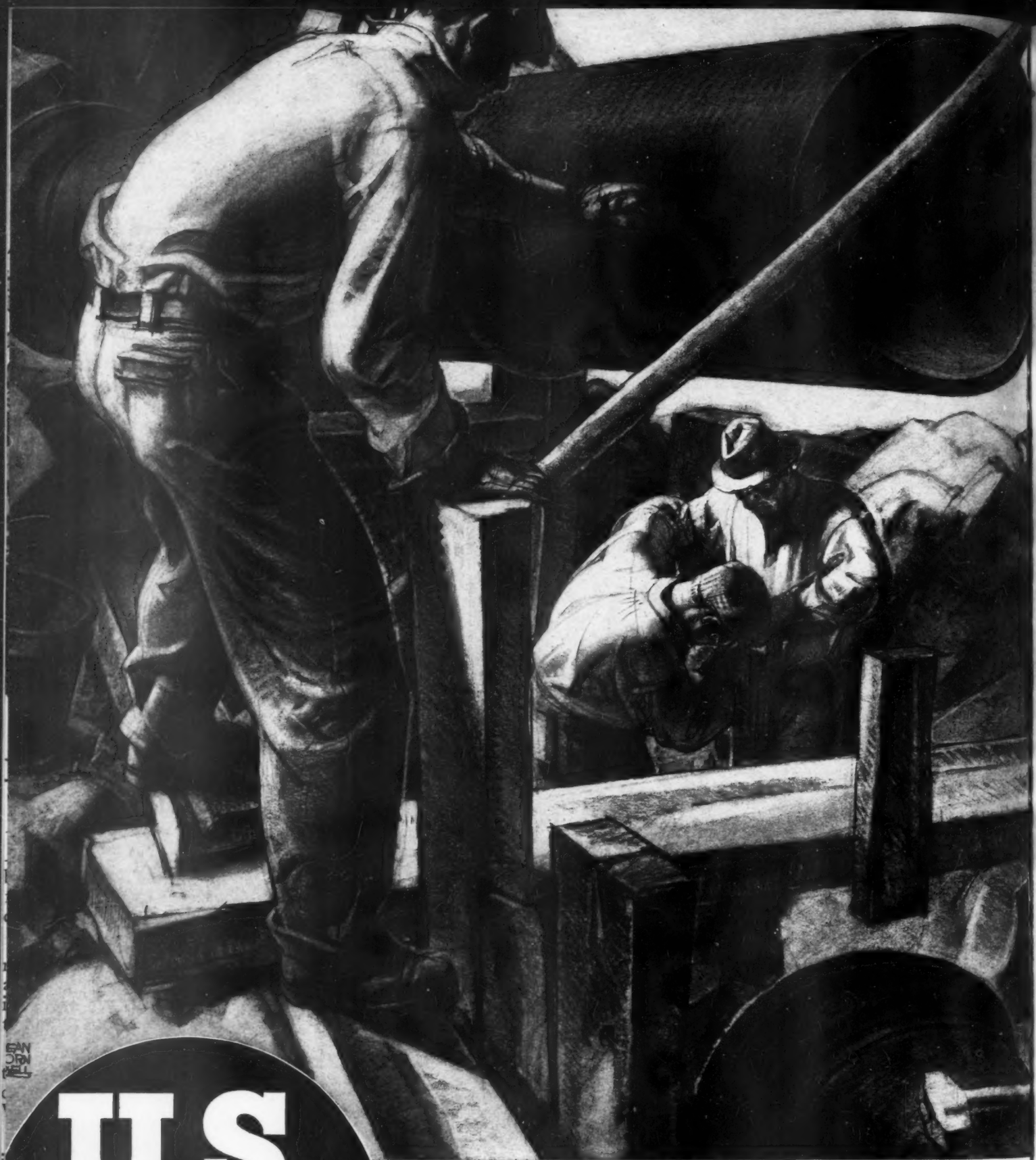
MERCO NORDSTROM VALVE CO.
NEW YORK BUFFALO PHILADELPHIA Main Offices PITTSBURGH, PA. DES MOINES CHICAGO COLUMBIA MEMPHIS OAKLAND HOUSTON



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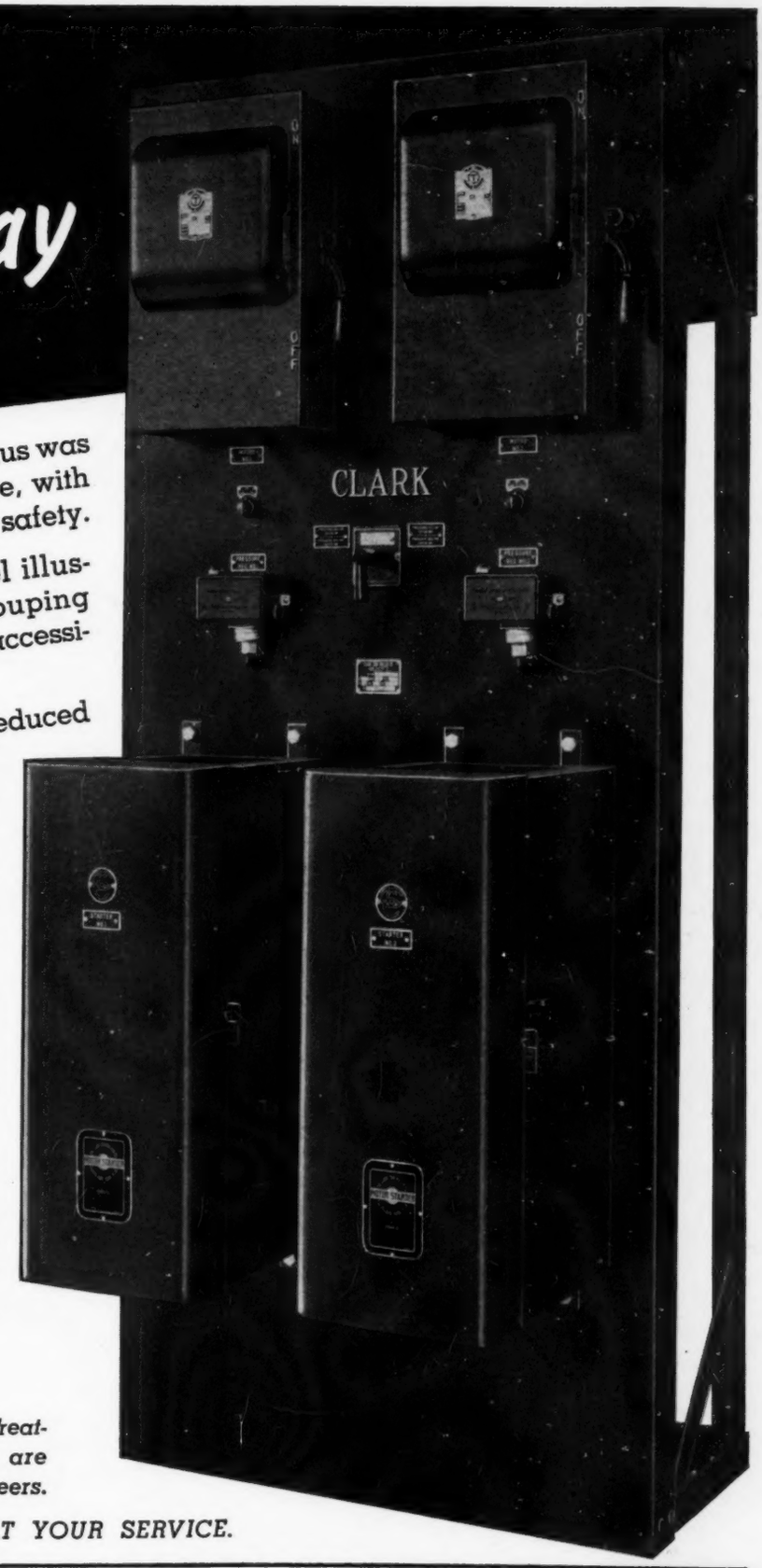
**U. S. PIPE AND FOUNDRY CO. General offices: Burlington, N. J.**

Plants and Sales Offices Throughout the U. S. A.

Makers of centrifugally or pit cast pipe for water, gas, sewerage, drainage and industrial services.

# The Modern Way




Not so long ago, control apparatus was mounted in any available space, with no thought for appearance, nor safety.

This neat floor mounted panel illustrates the modern way of grouping control apparatus for neatness, accessibility, and safety.

Here, two "3C" Bulletin 5840 Reduced Voltage, Primary Resistance Type starters with Fusible Disconnect Switches and Pressure Controllers are mounted on a neat Steel Panel, connected to present a Dead Front Panel.

Two 15 H.P., 550 V., 3 ph., 60 cycle squirrel cage Pump Motors—each Pump of 250 G.P.M.—provide Booster facilities for a New England Water Works.

The panel offers complete transfer facilities for Pressure Control or Manual operation of either or both Pumps, and arrangements for padlocking the apparatus are provided.

*Water Works and/or Sewage Treatment Pump Control problems are being solved daily by "3C" engineers.*

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OFFICES IN PRINCIPAL CITIES

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1146 EAST 152ND ST. CLEVELAND, OHIO


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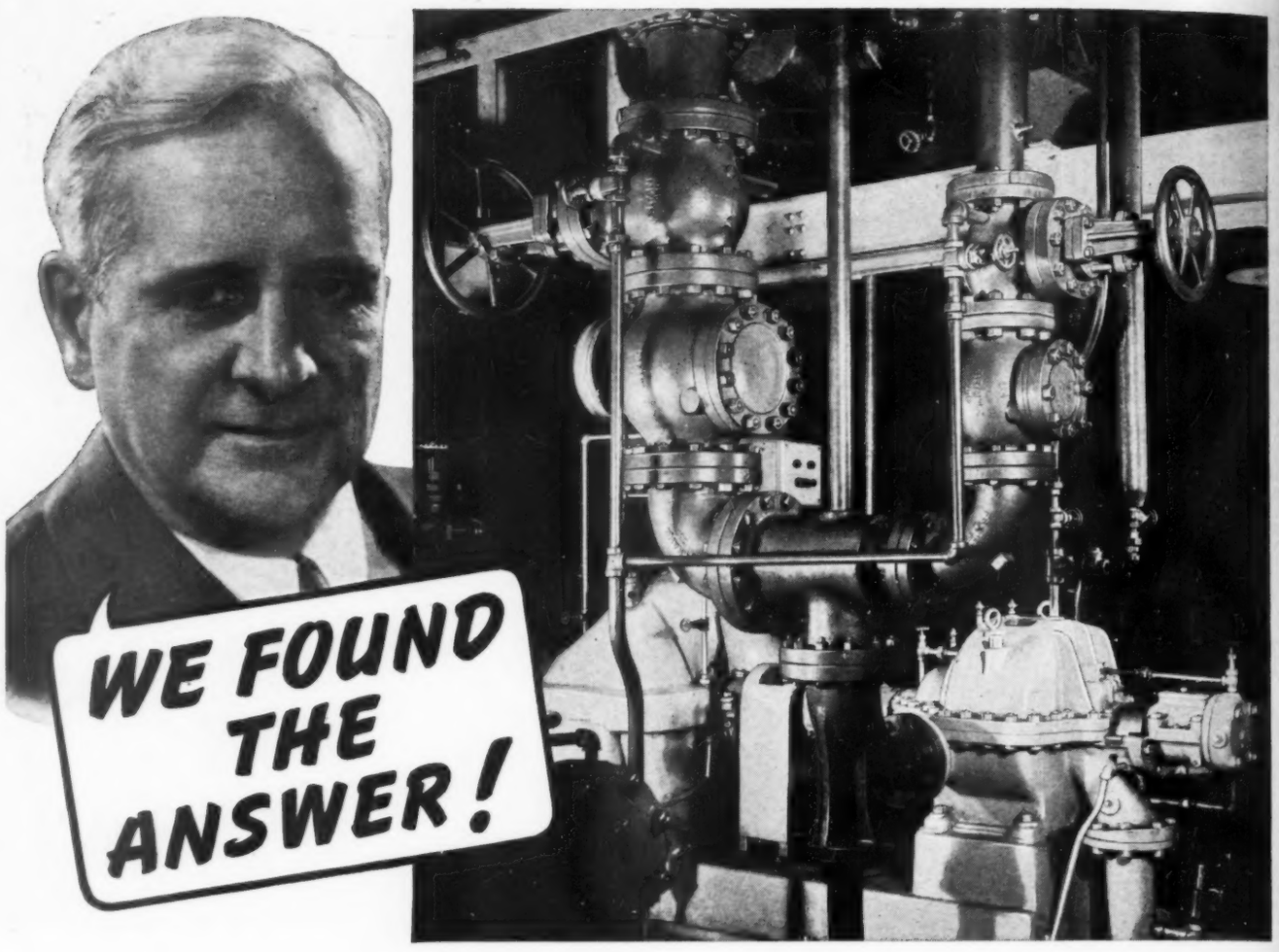


# "PREVENTIVE MAINTENANCE keeps our piping costs down"

*ACTUALLY, it's nothing new—many hundreds of plants are doing it every day. It's just a matter of using good foresight when you're buying valves and fittings.*

Preventive Maintenance is simply this: It means fortifying your piping with extra resistance to the stress and strain of service conditions. There lies your greatest assurance of dependable flow control at minimum cost. And it means making sure that your piping equipment is right for the job to be done—right for the safety required.

Whether your plant is small or large—with Crane valves and fittings you can carry on a successful program of Preventive Maintenance. That's because in Crane-Quality you get the finest development of design and materials in flow-control equipment. And in the Crane line of over 38,000 items is exactly the one you need for efficient and economical piping in every application in your system.

Just as he has helped others, your Crane Representative will gladly work with you. Through him, Crane's vast experience in solving industry's piping problems is applied to your individual case. Back of him, at your service, are Crane's extensive resources of technical knowledge, Crane's elaborate research and plant facilities.

If you *now* have a piping problem that's giving you headaches, then get started *now* on a Preventive Maintenance program. You'll save many dollars—you'll have peace of mind. Call your Crane Representative today. He is ready to serve you.

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NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

# DIAMOND LIQUID CHLORINE

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Because of its absolute purity and year around uniformity Diamond Liquid Chlorine assures positive bacterial control under all conditions of service . . . aids modern sewage disposal . . . prevents disease contamination in public swimming pools. Municipal engineers, too, like the quick and prompt deliveries of Diamond Chlorine in the modern trouble-free containers. Your local Diamond distributor will welcome the opportunity to serve you!

**DIAMOND ALKALI COMPANY . . . PITTSBURGH *AND EVERYWHERE***

# 4 tough problems

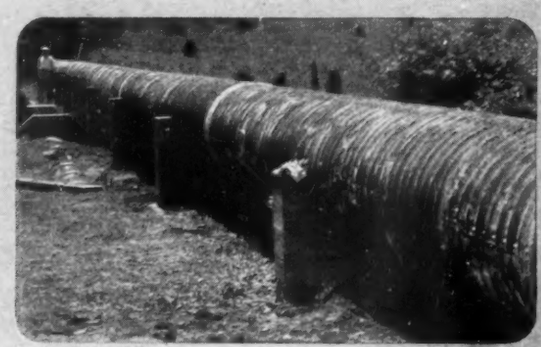
## THAT CALL FOR ARMCO SEWER PIPE

**UNSTABLE FOUNDATIONS:** Where shifting soils are likely to undermine and disjoint short sectional pipe, Armco Sewer Pipe offers a happy solution. No costly cradles or piling are needed to hold it in place because its long, flexible sections are tightly bolted together.

**SHALLOW COVER:** In this "trouble zone" you can save much grief and expense by using Armco Sewer Pipe. Being flexible, it readily absorbs all the pressures resulting from frost action, sudden traffic impact and vibration. Moreover, tree roots won't clog an Armco Sewer.

**DEEP TRENCHES:** To eliminate breakage and infiltration in deep sewers many cities are turning to Armco Sewer Pipe. When properly installed, it's virtually uncrushable because the corrugated metal design distributes the heaviest loads uniformly and harmlessly around the pipe.

**AERIAL SEWERS:** In crossing ravines or bridges Armco Sewer Pipe brings many desirable advantages. Because of its long lengths and freedom from excess weight it requires fewer and less costly supports. Besides, every joint can be made absolutely watertight to prevent leakage.



When sewers must serve under "tough" conditions like these, you'll save money and avoid trouble by using Asbestos Bonded Armco Sewer Pipe. Its flexible corrugated metal design and tightly coupled joints eliminate all danger of breakage or disjointing. Besides, Armco Sewer Pipe offers you this three-way assurance of long material life: (1) A galvanized base metal proved by more than 30 years of sewer service; (2) A smooth bituminous pavement that shields the bottom of the pipe from the scouring action of hydraulic traffic and a full coating of the same material that protects against acids, alkalies and gases; (3) A special asbestos bond that insures lasting adhesion of the bituminous material. Write for a free copy of the 48-page Armco Sewer Book, containing full information. Armco Culvert Mfrs. Assn., Middletown, Ohio.

**Asbestos Bonded**
**ARMCO SEWER PIPE**

A PRODUCT ORIGINATED AND DEVELOPED BY ARMCO ENGINEERS

# YEARS OF DEPENDABILITY

## 4 POINT CONTACT GATE VALVE

## AN UNDUPLICATED COMBINATION OF FEATURES

1. No Binding of Stem
2. Non-Rusting Packing Bolts and Nuts
3. Easy to Re-pack
4. No Scraping of Discs on Seats
5. Pressure Equally Distributed on Discs and Seat Rings
6. No Leakage
7. No Sprung Discs
8. No Incrustations
9. Gate Assembly Can't Fall Apart
10. No Side Strains on Stem

Be sure you have complete information on Mueller-Columbian Gate Valves before you specify. Detailed information and illustrations are ready for you for the asking.

# MUELLER CO.

SUTTONSEE, TENNESSEE

WHEN you set the carbon feed machine for a certain dosage—you like to know that dosage is fed. This is not possible when the carbon arches or bridges in the hopper. Hydrodarco is noted for its ease of feeding and its free flowing properties.

Because Hydrodarco is readily dispersed in the water, you get maximum utilization before the carbon is removed.

Hydrodarco flows freely and feeds freely at all times. It disperses easily. Its *high activation* assures the best job of palatability control per dollar. Specify Hydrodarco for your next order of activated carbon!

Hydrodarco—Reg. U. S. Pat. Off.

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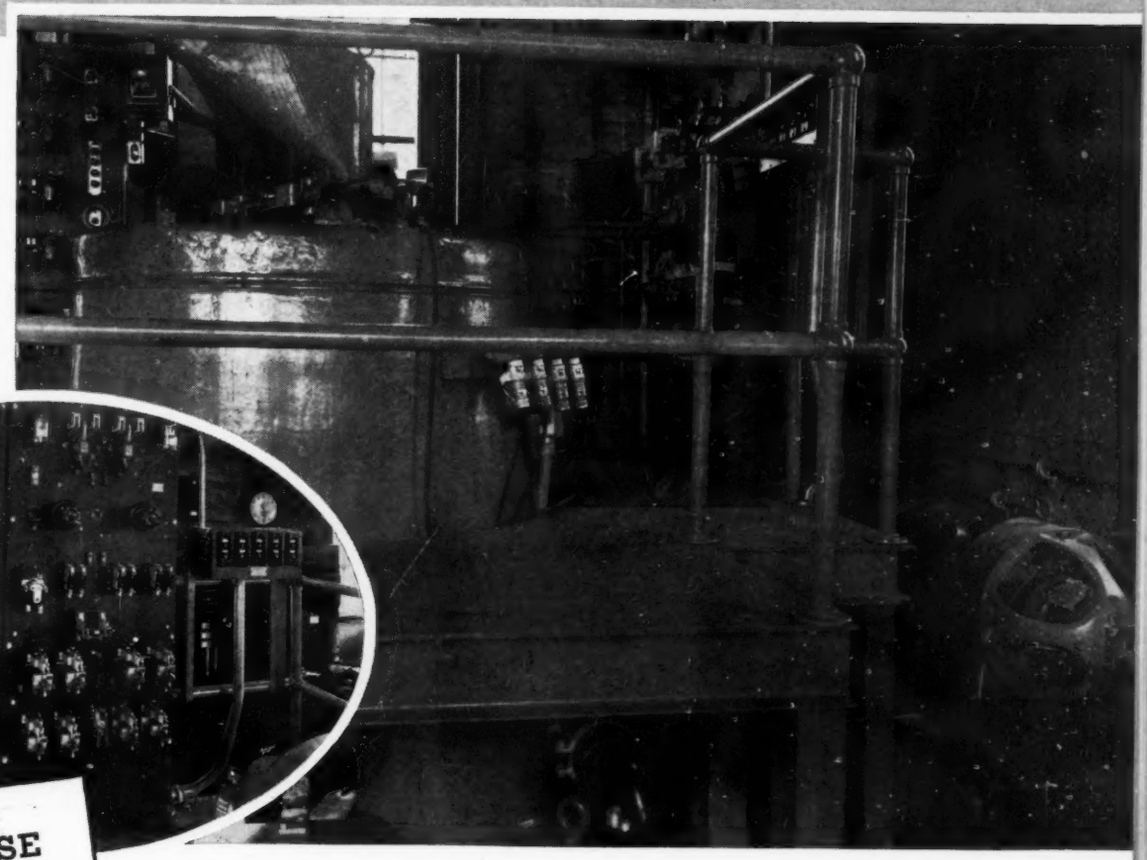
# 45% LESS POWER DEMAND

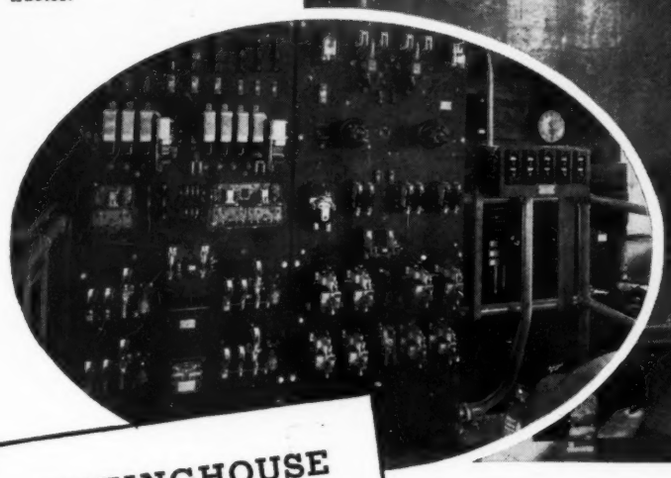
## *with variable voltage equipment*



General view, showing motor generator set at right, control panel at end of operator's platform, and enclosed extractor basket with feeding spout and cutter operating mechanism to the left.

•

Close-up of control panel and operator's push button station, for centrifugal extractor.



### WESTINGHOUSE EQUIPMENT INCLUDES:

D-C variable voltage motor generator set, composed of 75 hp induction motor, 50 kw d-c variable voltage generator and a 3 kw, 250 volt d-c exciter.

60 hp 230 volt, 600 to 1,800 rpm shunt wound motor for driving centrifuge.

1½ hp 230 volt, d-c gearmotor with 3 to 1 output speed, for driving cutters.

A-C agitator motor for stirring sewage in feeding tank.

A-C motor for driving belt conveyor.

Automatic control equipment for operating above motors and generators.

At the sewage plant at Elizabeth, New Jersey, an American Centrifuge operated with Westinghouse variable voltage equipment shows marked advance in efficiency, simplicity and operating costs, over an identical alternating current plant. Power demand charges are 45% less, off-peak power rates show saving of 34c per dry ton handled, and on-peak costs deliver similar substantial savings. And — completely automatic operation is afforded by the Westinghouse system of control.

This installation indicates the advantages that can be gained by a working partnership with Westinghouse, in electrification problems. For similar co-operation, address the Westinghouse District Office in your community.

*Westinghouse Electric & Manufacturing Company*
*East Pittsburgh, Pa.*

J-94148

# Westinghouse

ELECTRICAL PARTNER OF THE SANITATION ENGINEER

W WESTINGHOUSE ELECTRIC

# *Facts vs. Fancy re:*

# LEAKAGE

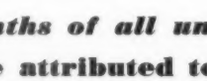
**The generally accepted average of unaccounted-for water is 15% of normal consumption. Everybody knows that *some* part of unaccounted-for water is due to leakage from mains. Experienced water works men know that leakage is only a small part and that *most* of the unaccounted-for water is attributable to a variety of other causes, many of which are necessary and unavoidable.**

* * *

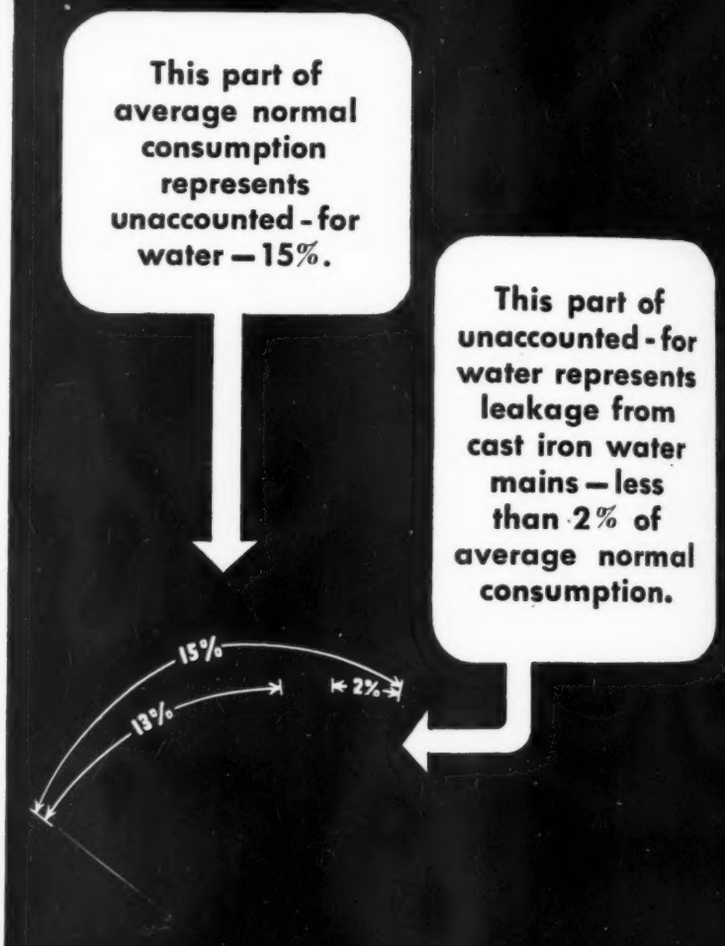
To ascertain how much of the 15% average of unaccounted-for water is actually due to leakage from water mains, we have recently conducted a leakage test survey of cast iron mains in 25 cities in 6 states. The mains tested range from several hundred feet to more than twenty miles in length, in sizes from 4″ to 30″ and up to 44 years old, either with no service connections or relatively few that were turned off during the tests. The average leakage per mile of pipe, per inch of diameter, per 24 hours was 41 gallons—or an average of 380 gallons per mile of pipe per day for the sizes tested. This leakage is less than 2% of the average of normal consumption per mile of distribution main per day. This survey, covering a broad average of water main construction and substituting facts for guesswork, shows that

***about nine-tenths of all unaccounted-for water* must be attributed to causes *other than leakage from cast iron water mains.***

**For further information write to THE CAST IRON PIPE RESEARCH ASSOCIATION, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Building, Chicago, Illinois.**




**Look for the "Q-Check" registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.**


This part of average normal consumption represents unaccounted-for water — 15%.
This part of unaccounted-for water represents leakage from cast iron water mains — less than 2% of average normal consumption.
15%
13%
2%
NORMAL CONSUMPTION OF WATER

# WATER WORKS & SEWERAGE

***Published Monthly by Gillette Publishing Company***

PUBLICATION OFFICE
330 South Wells Street Chicago, Ill.
E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street New York, N. Y.
L. H. Enslow, Editor

## COMING!

**In the Annual Review Numbers**

**Water—**
The customary annual review of "Developments and Trends in Water Supply and Water Purification," scheduled for January, is this year to be produced by that dynamic author whose previous reviews in this magazine have brought much favorable comment—
PROF. LEWIS V. CARPENTER,
Department Head,
New York University

**Sewage—**
For our February issue the annual review of "Developments and Trends in Sewerage and Sewage Treatment" is being produced by no less an authority than the Editor of "Sewage Works Journal"—
DR. F. W. MOHLMAN, Chief Chemist,
Sanitary District of Chicago

**"Experiences in Water Main Cleaning"**
Are those of the West Virginia Water Service Company, and should be helpful in assisting water utility managers to plan definite action in this same direction if they have been waiting for some further evidence to convince them that main cleaning is worth the cost. The Author—
WM. S. STAUB, Engineer
West Va. Water Service Corp.

**"Sewer Maintenance"** constitutes a recital of experiences in maintaining the sewers of Rockville Center, L. I.—plus a description of methods developed, equipment found most practical to employ for various purposes development of a systematic inspection and cleaning program record keeping and costs. The Author—
C. GEORGE ANDERSEN, Supt. of Sewerage,
Rockville Center, L. I.

**"25 Signs of the Master Salesman"**
Is an article by a "Master Salesman" which reveals his conception of what "Master Salesmen" are made of. We have purposely scheduled this article for the benefit of the many salesmen who admit that they do "glance through" **Water Works and Sewerage.** The Author—
J. G. FREDERICK
New York City

**"Experiences With Rubber Joint Packing"**
Is an account of experiences in Akron, Ohio, with the new sanitary and easy to use flexible rubber joint packing rather than the dirty bacteria harboring hemp and jute packings of "yesterday". These practical experiences come from—
W. R. LA DUE, Chief Engr. & Supt.,
Department of Water, Akron, Ohio

**"Porous Plate Filter Bottoms"**
Seem to be gaining popularity. Our November issue carried an article on the recent Larchmont, N. Y., installation. In the article scheduled a sizeable porous bottom installation by the Ford Motor Company at Flat Rock, Mich., placed above the existing perforated laterals to eliminate the trouble making gravel beds, is described. The Author—
L. R. STEVENS, Supt. Filtration
Ford Motor Co., Flat Rock, Mich.

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Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879. Published monthly at 330 S. Wells Street, Chicago, Ill. Per Copy, 25c. Subscription rates, United States and Canada, $2.00 per year; Foreign, $3.00 per year. Copyright, 1939, by Gillette Publishing Company, Publishers of: Water Works and Sewerage, Roads and Streets, Mida's Criterion, Oil and Soap, Powers' Road and Street Catalog and Data Book.

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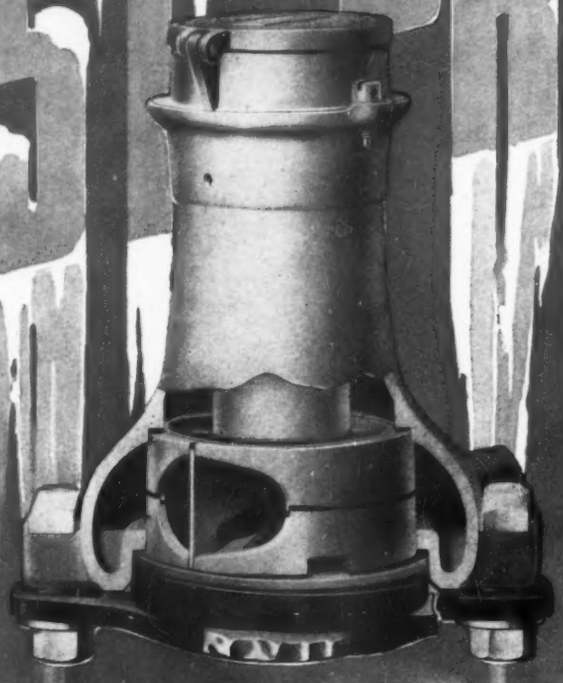
Chicago Office, 330 S. Wells Street. Cleveland Office, 1217 St. Charles Avenue, Lakewood, Ohio. New York Office, 155 East 44th Street. San Francisco Office, 155 Montgomery Street. Los Angeles Office, 318 W. Ninth Street.

Addresses will be changed as frequently as requested, upon notification at least two weeks before date of the next issue, in order to be effctive for next number. Immediate notice should be given of any delay in receipt of magazine.

# Trident FROST PROOF



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WATER WORKS & SEWERAGE

VOL. 86, NO. 12 *A Gillette Publication* DECEMBER, 1939

# THE SOUTHWEST'S BIGGEST WATER WORKS SHOW

## Staged in Dallas, October 16th-19th

WHEN the curtain fell on the Dallas Convention of the Southwest Section of A.W.W.A., and the tally of paid registrations ran up to 422, a new record had been established in respect to size of water works conventions in the Southwest.

So much for quantity. Long before the curtain fell had a record also been established for convention quality. The more significant did this fact become, when recalling the record establishing Oklahoma City Convention of 1938, which we consider to have constituted a tough mark to shoot over. Apparently the Dallas convention committees swore that they would do it—and did!

Of considerable significance, also, was the membership increase shown by the Section. When the convention opened, Chairman Rohan and his Committee reported a gain of 42 members. Before the "steer-roping" contest, conducted throughout the convention, was completed it had netted an additional 40 head to make a total gain of 82 new members in the "round-up." That's going to be a tough record for any Section to beat, and "Rohan's Steer Roping Team" sure has a double-hitch on A.W.W.A.'s Hill Cup for gain in membership between conventions.

***Awards and Prizes***

To *LEROY H. SCOTT*, Superintendent of Water and Sewage Treatment, Oklahoma City, went the George W. Fuller Memorial Award, in recognition of his contributions to the advancement of water and sewage treatment practices. He was cited for two principal recent developments—(1) The adaptation of under-water gas burning in developing the interesting scheme of recarbonation of water by simple and novel submerged combustion; (2) for his part in developing the Scott-Darcey Process of continuous ferric chloride production from scrap iron and liquid chlorine, for use as a water and sewage coagulant. (The submerged-combustion scheme was described by Mr. Scott in an article appearing in the October issue of this magazine.—Ed.)

**The New Chairman**

*M. B. Cunningham Sup't.-Engr. Water and Sewerage Oklahoma City Okla.*

**Fuller Award Recipient**

*Leroy H. Scott Sup't. Water and Sewage Treatment Oklahoma City Okla.*

*NELSON A. MINER*, Junior Engineer, Dallas Water Department, was winner in the Gadget Contest, his entry being a highly useful device for lowering into wells and securing photographic records of the condition of the casing and other parts of the well. (The winner also had entered a home-made pipe locator of the battery and coil type weighing but 9 pounds. He and his associates had constructed six of these useful locators for the Water Department.—Ed.)

***Entertainment and Exhibits***

Entertainment consisted of the enjoyable opening reception and dance and the brilliant closing dinner-dance but the novel and hilarious "Gay Nineties" party and smoker, with a Flora-Dora type of stage show to add spice, was considered the bell-ringer.

Winners of the Golf Tournament were:

Low Gross, Clyde T. Norman, Engr., Dallas Water Dep't.

Low Net, J. R. Gilstrop, Haskell, Tex.

The ladies were sumptuously entertained with teas, fashion shows, bridge, luncheons, etc., and while on a sight seeing trip the men visited the Dallas Water Works and the new Sewage Treatment Plant, now nearing completion.

The manufacturers' exhibits were well and spaciously arranged between the registration desk and the meeting room. There were 32 exhibitors —also a record. (See list at end of report.)

*Exec. Sec'y.—Harry E. Jordan (A.W.W.A), President—J. Arthur Jensen (A.W.W.A.) (Sup't. Minneapolis Water Dep't.), Chairman — Albert Davis (S.W. Sect.) (Sup't. Water & Sewerage, Austin, Tex.)*

To the "Three Horsemen" in charge of entertainment and exhibits —W. & T.'s Fred Puckhaber, Dave Morey, and Neptune's Egmont Smith —went a deserved vote of appreciation from the Association.

### *The President Speaks*

At one of the luncheon sessions, J. Arthur Jensen, President of A.W.W.A., presented a splendid review of developments in water supply practice and the status of the Association. He pointed out that there were now 9,336 municipally owned and 3,424 privately owned water supply systems (a total of 12,760) supplying 13,293 communities in North America. Amongst these, 9100 supplies were from ground sources, 2126 from streams and 797 from lakes. There are 2,091 filter plants, 484 softening plants, 417 iron removal plants; 4,015 supplies depended upon chlorination alone, 551 employed ammonia and 636 activated carbon.

As to sewage treatment, the considerable recent growth in this phase of sanitation had increased the total treatment plants to 4,667. With this growth in sewage treatment a noticeable increase in inter-connection of water and sewage works operation and collections of sewer charges by water departments had been in evidence. The trend was to larger services and increased sales of water.

As to the effects of the war on water works operation, Mr. Jensen said that with good public relations and satisfied employees there was no need for concern.

Concerning A.W.W.A. it was interesting to look back 10 years for a picture of "yesterday and today," and pointed out that the Association continued its up grade strides, with the present Secretary at the helm. Although the ideals of A.W.W.A. were higher than a mere increase in membership, it did take money and men to make the desired strength needed by such a National organization, if it was to become wholly effective. On that score it was extremely gratifying to see the growth in member numbers taking place. It was particularly pleasing to note such results in the Southwest as the 75 members taken in during the current convention; and, also to note the record attendance. (As noted earlier, the number of members reached 82 before the close of the convention.—Ed.)

### *A Happy Secretary*

A happy Secretary was Harry Jordan to see the vigorous activity of the Southwest Section, and he made as much plain in commenting on the loyalty of its "wheel-horse" members. Never had he appreciated the spirit of a Section meeting any more than this one, was his sincere statement.

Besides making radio talks and speaking before local technical groups, Mr. Jordan made an inspired and inspirational talk during one of the luncheon sessions. Speaking on world conditions and, more specifically, of opportunities for attainments in the field of public service and their bearing on the future of the country, he warned of the dangers of privileges and privileged classes if we would avoid Hitlerism in America.

**No. 1 Dallas Host**
*John B. Winder Sup't. Water Works & Sewerage (Chairman of Program Committee)*

**Texas Host**
*"Vic" M. Ehlers Chief Engr. Texas State Dep't. of Health (A "War-Horse" 'mongst State Sanitary Engrs.)*

### *Officers*

The following officers were unanimously elected:

Chairman — M. B. Cunningham, Engr.-Sup't., Water Works & Sewerage, Oklahoma City, Okla.

Vice-Chairman—A. M. Brenneke, City Engr., Denison, Texas.

Sec.-Treas.—L. A. Quigley, Sup't., Water Works & Sewerage, Fort Worth, Texas.

**No. 1 "Gadgeteer"**
*Jr. Engr.—Nelson A. Miner, Dallas Water Department (And his prize gadget)*

**Major "John B."**
*Major John B. Hawley of Fort Worth (Retired Consulting Engineer whose hobby of fresh water biology has won him fame)*

Trustees:—Bernard Allen, Bytheville, Ark.; J. J. O'Donnell, Bossier City, La.; Percy Daniels, Perry, Okla.; T. C. Green, Austin, Tex.

### *Tulsa in 1940*

Tulsa, Oklahoma, was chosen as the Convention City of 1940.

## *Technical Sessions*

(Chairman A. H. Davis Presiding)

The Technical Sessions were opened with a brief recounting of the status of the Southwest Water Works Journal now having a net worth of something better than $1700 and of the Section, with net resources of $2100. He called attention to the splendid work of George Rohan and his Membership Committee in bringing into A.W.W.A. 44 new members. (Applause.)

Then at the request of the Chairman those present stood looking into the West for one minute as a memorial to two distinguished members who had passed on during the year—Alfred Theard, Superintendent of Water and Sewerage at New Orleans, and Jesse Shaw, former Superintendent of Water and Sewerage at Tyler, Texas.

**"Saving Money for the Taxpayers"**
by THOMAS L. AMISS, Sup't. of Water and Sewerage, Shreveport, La.

Mr. Amiss' very thought-provoking discussion, presented in his characteristically straight-from-the-shoulder manner, had to be read in his absence which was unavoidable and represented one of the very few conventions missed by the author, the immediate past-chairman of the Section.

Briefly put, Mr. Amiss deplored the fact that inefficiency is too generally accepted as a condition difficult to avoid in municipal plant operation.

**The "Three Horsemen"**

*Dave Morey, Jr., Cons. Engr.; Fred. Puckhaber, W. & T. Co.; Egmont Smith, Neptune Meter Co. (To Chairman Puckhaber, and the two other "horsemen," of the Committee on Exhibits and Arrangements, went a deserved vote of appreciation.)*

Unlike private industry, municipal operators were too prone to put up with obsolescent equipment wasteful to operate and costly to the taxpaying public. Not alone in machinery, but in personnel was obsolescence taking its toll through the substitution of inefficient individuals.

The South had taken the direction of replacing the effective and useful negro buck by decrepit whites under the guise of unemployment relief. The thought too frequently expressed by department heads was—"Well if the people do not worry—why should we?" If there ever was erroneous and dangerous psychology this was it—said Mr. Amiss.

For the good health of the Water Department Mr. Amiss said that managers must bring home to governing bodies a realization that water work structures are supposed to house an industry; *not a museum.* Wisdom and some consideration of the managers future dictated insistence on efficient equipment and capable personnel; and, wise but not lavish planning. [The author, a keen observer and former manager of privately owned water plants, and for the past several years in charge of the municipally owned Shreveport plant, was peculiarly well fitted to "speak his mind" on the folly of accepting deficiency and obsolescence in municipally owned water works operation. His paper hit many nails squarely on the head.—Ed.]

**"Checking Private Water Supplies"** by D. M. Baake, Director, Houston Laboratories, Houston, Texas.

Mr. Baake, formerly Water Works Chemist at Dallas, was amongst friends. His paper dealt with the matter of private water supplies and their history in causing unfavorable typhoid and dysentery records in cities where existing. And, in turn, a reflection on the public water supply. To avoid such and to preclude hazards from cross connections, Mr. Baake stressed the fact that the Water Department or the local health authorities should conduct routine inspections and examinations of all such private supplies. The smaller cities would probably find it advantageous to employ private laboratories to make a thorough initial survey and a follow through in securing needed corrections.

Mr. Baake's paper brought on a question from the floor of how to justify extensions of public supply mains into sparsely settled fringe areas and development now having private supplies, and possibly unsafe ones. It developed that in Texas one method involved the formation of Water Districts comprised of a sufficient number of properties to issue

**Hosts**

*Joe J. Murray (Sup't. of Accounts and Collections); L. C. Billings (Sup't. of Filtration); H. P. Kucera (City Attorney)*

bonds and construct the extension main, after having entered into a long term contract with the city for water at wholesale rates. Where the properties were too few to form a Water District the owners had paid for the main extension and were then supplied water at metered rates 150% of those within the city limits.

**"Dealing with the Public"** by Joe J. Murray, Supervisor of Accounts and Collections, Dallas Water Department.

Joe Murray came into the Dallas Water Department well equipped to handle its public relations work. He was trained to be a preacher and, from all accounts, he was a good one and did a swell job of pleasing many, so John Winder persuaded him to do the same sort of job on his customers.

Mr. Murray came to say a few words of wisdom for the benefit of others faced with customer difficulties. Here are a few pointers and facts from the rangy ex "sky-pilot":

(1) In receiving a complaining customer, mistake No. 1 was that of trying to explain too soon. The maxim is "Let 'em talk." He or she will eventually run out of talk, and slow down.

**Host-to-be and Hats**

*J. E. Rosequist, Sup't. of Water, Walnut Springs, Texas; W. F. McMurray, Sup't.-Engr., Water Dep't., Tulsa. (Took back home in his pocket the 1940 Convention); A. B. Cole, Sup't. of Water, Midland, Texas. (Found to be a regular—high heel, pointed toe boots, and all.)*

(2) Then it's time to do a little acting. Express marked surprise that he or she had not come in earlier. Make it a point to offer to do all possible to solve the problem, if given just a little time.

(3) Whenever possible hold back the excessively high water bill until a leak inspection has first been made and the customer given some inkling of what's in store, and that the Department realizes that something is wrong with his water bill or his plumbing.

(4) Double checking in the meter reading and accounting departments may save that single blunder which costs the good will of some satisfied customer of 20 years standing.

(5) Good public relations, like charity, begins at home—i.e., within the Department and, for real success, must be cultivated there.

Mr. Murray pointed out that mutuel distrust of utility employe and the customer was the first obstacle to be overcome before the double wound could be healed. He spoke of the value of radio to disseminate water works information to the public and thereby advertise. He also referred to such things as the "Approved Water Supply" signs of the State Department of Health on highways leading into the city. Such were assets in building confidence in the local supply. The use of the backs of water bills to carry to consumers messages from important civic organizations had proved a helpful means of building good will. It was important for water operators to always reflect that more than the product, it is a service 1440 minutes in every day that they are selling. Make it a point to impress as much on customers and the public at every opportunity.

**"The Denison Dam"** by CAPTAIN L. D. CLAY, Distr. Engr., U. S. Engineers Office, Denison, Texas.

Captain Clay presented a description of the interesting earth-fill dam under construction on the troublesome Red River near Denison, Texas, which is to serve as a flood control and power dam, developing up to 125,000 KW. and costing $51,000,000 to construct. A somewhat startling revelation was the fact that this flashy river varies in flow anywhere from 85 to 470,000 cu. ft./sec. at Denison. There is probably no equal amongst American streams, therefore it has been necessary to provide a 2000 ft. spillway and a 30 ft. freeboard. Since 20,000 acre/ft. of silt may be deposited in the reservoir in a single year, planning for 1,000,000 acre/ft. of silt storage had been necessary. Since flood may come in any months of the year it had been necessary to provide for rapid release of flood waters entailing 4 conduits 1000 ft. long and 20 ft. diameter (lined with ½-in. steel to withstand water hammer) and design a stilling basin to drop velocities to 18 ft./sec. to avoid limestone cutting below the dam.

In power generated, the expected economic normal is 12,000 K.W. operating on 2,000,000 acre ft. storage available during the year of minimum expected river flow without allowing the elevation to rise closer than 23 ft. of the spilway to absorb floods.

## *Filter Washing*

**"Keeping Filter Sand Clean"** by THOMAS C. GREEN, Sup't. of Water and Sewage Treatment, Austin, Texas.

Mr. Green presented a general discussion of filter bottom design vs. operation, with the conclusion that filter bottoms needed more study. Impressive was the gravel bed eliminating bottoms of porous plates, recently introduced. Concerning filtering rates, he felt that there should be no specified limits, since only the extent of raw water preparation seemed to be the limiting factor. When to wash would be determined by head loss (on fine grain bed units) or the appearance of turbidity in the effluent of coarse grained units. The practice at Austin was to wash when the effluent turbidity reached 1.5 ppm. recorded with the sensitive Baylis Turbidimeter.

With units containing fine sand, at Austin air binding had been a chief trouble. When turning on the wash water the beds had "blown up," resulting in inversion of gravel and sand. (This Mr. Green did not point out would have been impossible with porous plate bottoms and elimination of gravel bed.—Ed.)

**"Filter Washing—Theory and Observation"** by EDWARD R. STAPLEY, Prof. Oklahoma A. & M. College, Stillwater, Okla.

Prof. Stapley presented a review of observations which proved the argument that a filter bed could be too clean was fallacious, everything now pointing to the values of extremely clean beds. This in turn had led to the adaptation of mechanical and jet washes to produce sand scour and maximum sand cleansing. The effectiveness of high velocity water-wash had justly been questioned, because of its expense and failure to keep beds clean. It was probable that the pendulum would swing to a scour-cleansing, lower vertical rates in washing and filter beds coming up to the very bottom of the wash troughs.

**"The Advantages of Metaphosphate Treatment Over $CO_2$ for Stabilizing Softened Waters"** OWEN RICE, Research Engineer, Calgon Inc., Pittsburgh, Pa.

Mr. Rice's paper was essentially the same as that presented before the New England Water Works Association in September and reported in our October issue. "Threshold Treatment" with hexametaphosphate in dosages of 1 to 2 ppm. inhibits after precipitation from lime softened water and thereby substitutes for recarbonation with carbon dioxide. In discussing costs Mr. Rice said that 1 ppm. of "Calgon" entailed expenditure of $1.40 per million gallons thus comparing favorably with recarbonation at a cost of $0.60 to

**Group at the Bachmann Filter Plant,**

$2.00 per million. Its use involved only the simplest sort of inexpensive feeding equipment and furthermore had no lowering effect on the pH, nor did it put back into solution already precipitated calcium carbonate, as does recarbonation. In its ability to maintain the corrosion inhibiting high pH and its effect on metallic surfaces, it played an important part in reducing dead end and red water trouble. Likewise, in preventing depositism in hot water systems.

**"Distribution System Practices"** by D. W. ROBINSON, Engineer, Community Public Service Co., Fort Worth, Texas.

Mr. Robinson in his very comprehensive paper pointed out that it cost more today in piping to provide water service than ever before; that consumption habits made it necessary to design for sharper peaks in demand rates. In small towns the proper size mains for fire protection answered all other problems.

He recommended a wider use of A. W. W. A. specifications for laying of C. I. pipes. Personally, he preferred tamping to trench bottom shaping, and was against the practice of blocking. Concrete pipes could be considered good for 75 years at least, but only recently had asbestos-cement pipes been approved for Texas distribution systems. Its advantages in lightness and ease of laying were impressive. In regard to service pipes, there had been a lack of scientific methods in selecting the proper material and size for the service. In his opinion the size should be such as to approach the combined area of all openings on the property.

Concerning meters, Mr. Robinson referred to the availability of the new type of small "IMO" meter designed to provide great and sustained accuracies. Standardization of meter register dials was something to be desired. In the matter of the assumed desirability of standardizing on certain types of equipment, such could be carried too far in his opinion. There were improvements and changes in competitive equipment to be considered.

This session closed with a motion picture of the manufacture, handling and laying of "Transite Pipe."

## *Sewerage Session*

**(T. C. Green, Presiding)**

**"The Hays Process of Sewage Treatment"** by CLYDE C. HAYS, City Chemist, Waco, Texas.

Mr. Hays, who, in 1928, conceived a unique biological process of sewage purification, now bearing his name, has since developed and perfected his process up to a point where it is in actual use at Elgin, Texas, and soon to be in use at McGregor, Texas. In brief the Hays Process consists of two distinct stages of treatment—the first involving tanks with submerged plates on which sewage solids deposit and undergo change while air diffusion upwards through the vertically suspended plates keeps the process aerobic. The first stage is the bio-decolloidizing stage. Effluent therefrom is freed of suspended solids in an intermediate settling tank and then passes to the second stage aeration units. In the latter oxidation and intrification takes place. The effluent of the second stage is settled before discharge to the stream.

Mr. Hays after briefing the history of the development of the process, described the first installation—that of Elgin, Tex., which has a capacity of 150,000 gpd. and had cost $16,000 to construct. The plant comprises bar screens, a primary sedimentation tank, first stage contact aeration unit, intermediate settling tank, secondary contact aeration unit, final settling tank, separate sludge digestion units, and sand beds. For air blowing two Roots-Connersville low pressure blowers deliver air against a 6 ft. head (2.68 lbs./sq. in.) at the rate of 135 cu. ft./min. to the two aeration units. The plant requires one man's time for about 2 hours daily. The average current consumption has been 46 k.w.h. per day resulting in a monthly billing for current of $13.80. Typical analyses presented showed an 80% reduction in B.O.D. through the first

**Southwest Section Convention, Dallas, Texas**

*(1) P. G. Price, A. P. Smith Mfg. Co., Chicago; (2) J. C. Harris, Sup't. of Water Works, Electra, Texas; (3) J. W. Schonhardt, Sup't., Water Works & Sewerage, Marshall, Texas; (4) Moultrie Smith, Sup't., Water Works & Sewerage, Nacogdoches, Texas; (5) R. O. Williams, Supt., Water Works & Sewerage, Clinton, Okla.; (6) Walter Hicks, City Engr., Paris, Texas; (7) Henry Perkinson, M.&H. Valve & Fittings Co., Anniston, Ala.; (8) J. J. Zumwalt, Sup't. Water & Sewerage, Frederick, Okla.; (9) Clinton Inglee, Pres., Nat'l. Water Main Cleaning Co., N. Y. City. (A bridegroom of a few days hence when this picture was snapped.)*

stage and intermediate settling. The final effluent had a B.O.D. value of only 6.2, and nitrate content of 36 parts.

The plant provides a contact aeration period of only 1 hour in each stage—with settling, a total detention time in the plant of 4 hours. One cubic foot of air per gallon is required at 4 lbs. head. The plant requires an area one-half that for a conventional activated sludge plant and costs 33% less to construct. The process has required about two-thirds the energy required by the activated sludge process for like purification. The process seems especially well adapted to treatment of industrial wastes, there being no recirculation or sludge return involved.

The contact media in the Elgin plant consists of stone 2½ to 3½" diameter through which sewage and air flows upwards. Air is admitted through a grid of aluminum tubing perforated with ⅛" holes 1 foot apart. The sloughing solids drop to a hopper beneath the false bottom, constructed of steel rails and ⅞" square bars. Mr. Hays pointed out that for larger installations the contact surfaces would be supplied through use of corrugated "Transite" sheets.

In reply to questions, Mr. Hays stated that the process was superior to the activated sludge process presumably because it proceeded more orderly and was less susceptible to upsets, since there was no return of sludge. Power costs were about 33% less. The process was to be sold on a royalty basis.

In a written discussion, E. W. Steel, Professor of Sanitary Engineering, Texas A. & M. College, stated that he had found that Hays' scheme always remained on an even keel, producing a high grade effluent consistently. He attributed this desirable feature to the fact that the purification development in orderly progressive stages, very much as takes place in trickling filters. Prof. Steel drew attention to the fact that 330 ppm. alkalinity in the settled sewage of Elgin had been reduced to 30 parts during the treatment. This interesting phenomenon had not been explained.

**"High Capacity Filters" by** LEE H. POWELL, City Manager, Temple, Texas.

Mr. Powell described the new treatment plant of Temple, involving a circular high-rate "Aero-Filter," with a revolving spray distributor located at the center and covering but 30% of the bed. When in rotation at 6 rpm. it throws spray to the

**Programmers**

*G. L. Fugate, Chief Eng'r., Houston Water Dep't.; D. W. Robinson, Eng'r., Community Service Co., Fort Worth; L. A. Jackson, Sup't.-Mgr., Water Dep't., Little Rock, Ark.*

edges of the 61′ diameter bed composed of crushed stone 1½ to 3" diameter. The normal rate of 20 mgd./acre is automatically maintained by recirculation of effluent. Mr. Powell pointed out that a filter of 140′ diameter would have been required for the older slow rate filtration scheme.

Effluent of the plant is to be employed in irrigation. Sludge from the final clarifier and crude sludge is digested in a heated unit, equipped with Downes' Floating Cover. Operating results had not been obtained at the time of preparing the paper.

H. L. DABNEY, Ass't. Engr., Texas Dep't. of Health, in discussion, reviewed Levine's early studies revealing the value of high rate filtration over the low rate process, pointing out that high rate applications correct trickling filter difficulties such as fly breeding, ponding and odors.

**"The New Treatment Works of Dallas"** by R. M. DIXON, Designing Engr., Dep't. of Public Works, Dallas.

Mr. Dixon's interesting paper revealed that the sewage of Dallas, containing industrial wastes, had proved to be nobody's "pet lamb." In experimental plants it had "tried the metal" of chemical precipitation, the activated sludge process, and trickling filters. As the result, trickling filter treatment had been chosen to withstand the flushes of industrial wastes which boosted B.O.D. values to between 800 and 1000 ppm. for periods and pH values 8 to 11. The normal B.O.D. of Dallas sewage is 300 ppm.

The new plant, rapidly nearing completion, is to cost $1,500,000 and was financed through P.W.A. with 10 year bonds at 2% interest. It involves screening, mechanical grit separation, grease separation and odor control by 4 minutes of preaeration followed by 4 minutes of "aero-chlorination," in a wholly enclosed and force draft ventilated building with spray tower. Screenings are to be shredded and returned to the sewage for sedimentation in existing 20 year old Imhoff tanks providing 1.5 hrs. detention, supplemented by a battery of new primary tanks with sludge and scum removal mechanism. From both batteries sludge is transferred to heated Multi-Stage Digestors. The trickling filter battery consists of 16 circulator units of 176′ diam. each and 7.5 ft. bed depth, designed for a B.O.D. loading of 640 lbs./acre/ft. Secondary settling units are designed for average flows of 900 gal./day/sq. ft. of surface equipped with red-wood baffling at influent and center points. Extra long weir edges provide 7 gals. per lineal foot of weir.

Interesting features of the plant includes a proportioning automatic Venturi controller which splits the flow between the Imhoff and mechanical clarifiers at a constant 25/75%

ratio, with 5% guaranteed accuracy in such splitting. The filters are to be fed through a novel automatic gate opening and closure, as the distributing mechanism instead of syphons. The distribution control to various units is specified to insure not greater than a 5% differential in volume to individual filters over the range of 15 to 70 mgd. flows. The 16 units may be operated at will as two 8 unit groups to provide series (stage) filtration. Final effluent may be recirculated through filters or returned to freshen and dilute the crude sewage, at will, to provide high or low rate filtration and fly and odor control.

In plant beautification $12,000 has been alloted for sodding 15 acres, planting 500 shrubs and otherwise landscaping the grounds.

(In an early 1940 issue of this magazine the new Dallas treatment works will be described in some detail by Mr. Dixon.—Ed.).

W. S. MAHLIE, Sup't. Water and Sewage Treatment, Fort Worth, Texas, in discussion, intimated that experience at Fort Worth would indicate that the B.O.D. loading of 640 lbs./acre/ft., as designed for in Dallas, indicated boldness and would probably be the upper limit. The steps taken for control of odors and grease removal were interesting and commendable, in as much as odor control was to be a primary problem at Dallas as it was at Fort Worth. Concerning sewage and sludge temperatures and hydrogen sulphide generation, Mr. Mahlie revealed that operating digesters at the lowest permissible temperature at Fort Worth had reduced the $H_2S$ in the gas by 33%. At Fort Worth, as elsewhere, the return of supernatant liquor had proved one of the greatest of operating "headaches," particularly in respect to hydrogen sulphide production in the bio-flocculation stage.

**"The Control of Sludge Bulking"** by E. M. BERG, Sup't. of Sewage Treatment, San Antonio, Texas.

Mr. Berg's paper, read in his absence, revealed the results of studies covering several years at the San Antonio activated-sludge plant in an effort to secure the most effective indices for use in plant operation control to avoid recurring sludge bulking. From past studies and present indications not less than 900 cu. ft. of air per pound of B.O.D. load on the aeration units was apparently the low safe air input. Under such conditions the sludge index becomes 2.5 for the mixed liquor.

A study had been made of the ratio of suspended solids returned to the aerators to suspended solids content of the crude sewage, this factor being termed "R." Good clarification resulted over the range R=3 to R=20. However, R=10 gave optimum results in respect to continuity of performance and economy under San Antonio conditions. With improved quality of sludge a higher ratio of recirculation solids could be maintained. Operating on the ratio of solids returned as 10 times those in the incoming sewage meant that the volume of recirculated sludge averaged 40% of the sewage flow. This was necessary because of the bulky nature of the sludge in the final tanks when operating on the basis of one pound of B.O.D. loading into the aerators for every 900 cu. ft. of air available. To preclude process upsets it was necessary to avoid exceeding the latter loading limits by use of the plant by-pass.

W. E. WHITE, Chemist, Sewage Treatment Works, Houston, Texas, in discussion, reported briefly on experiences with chlorine for bulking correction at Houston. Since 1937 various schemes of chlorine application had been tried but the most effective appeared to be chlorination of the returned sludge at a rate approximating a dosage of 5 ppm., the latter being based on sewage treatment without regard for the volume of sludge being returned or its solids content. The results had proven the scheme worthy and economical for controlling seasonal bulking and permitting higher continuous process loadings.

**Snapped at Two Luncheon Sessions**

(1) *President Jensen has just told one of his Sweedish yarns. Amused listeners—(l. to r.) Gale Dixon (Harrisburg, Pa.); J. Herman Smith (Boston); "Clint" Inglee (New York); W. V. Weir (University City, Mo.);* (2) *Secretary Jordan makes one of his best talks on "What's Ailing the World," or some such title;* (3) *In his audience (r. to l.)—E. D. Case (New York); Cy Bird (Chicago); Prof. W. R. Spencer (Fayetteville, Ark.); Prof. E. R. Stapley (Stillwater, Okla.).*

## *Superchlorination Experiences*

**"Superchlorination at Tyler, Texas"** by J. M. LLOYD, Supt. of Water, Tyler, Texas.

Mr. Lloyd's paper constituted a recounting of experiences with heavy raw water chlorination which has proved effective in correcting taste and odor troubles at Tyler during the past two years. Experimentation with 1 to 6 ppm. chlorine indicated intensification of odor with increasing dosages up to 4 ppm. With further increases an improvement was noted. At 6 ppm. there was no odor other than free chlorine. Applied in the plant the 6 ppm. dosage produced only 0.8 to 1 ppm. residual at the filters. The results had been so impressive that the treatment was continued on the basis of maintaining a chlorine residual of 0.6 to 1 ppm. entering the filters and 0.5 to 0.8 ppm. to the distribution system. The treatment, which was begun in the late summer when the water was in the poorest condition, was gradually reduced to keep pace with decreasing chlorine demands as cold weather came on. In winter the dosage drops to 2.5 ppm. only.

Other advantages cited by Mr. Lloyd included iron and manganese oxidation to assist flocculation and maintain clean sterile filters. Somewhat surprising was the fact that consumers had not found 0.5 to 0.8 ppm. residual chlorine objectionable and that no odor of chlorine could be noticed around the plant.

(It is opportune to recall that

(1) *Line-up for picture taking at the Dallas Filter Plant.* (2) *At the plant—Moultrie Smith, Sup't. of Water, Nacogdoches, Texas; Jack Harding, Badger Meter Co., Vicksburg, Miss.; A. B. Cole, Sup't. Water, Midland, Texas; Chas. Barry, Badger Meter Co., Guthrie, Okla.;* (3) *Group at the aerators and mixing chambers.*

*(1) B. J. Thorngren, Maintenance Engineering Corp. (Houston) and Owen Rice, Research Engr., "Calgon" Inc., Pittsburgh; (2) "Jack" Fugate, Chief Engr., Houston Water Works and Gale Dixon, Engr., Griffin Hagen and Associates, Engrs., Chicago; (3) D. B. Dixon, Sup't. of Filtration, Wichita Falls, Texas and Roy Duckett, Sup't. Water Works & Sewerage, Sweetwater, Texas; (4) J. L. Swanson, Sup't. of Filtration, Port Arthur, Texas, and E. C. Johnson, Sup't., Water Works & Sewerage, Jacksonville, Texas; (5) A. S. Barada, Jr., Barada & Page, Chemicals, Dallas and Jack Harris, Industrial Chemical Sales, Chicago.*

Tyler enjoys the distinction of having on two consecutive years received the highest rating on water supply improvements and water service of any Texas city. This distinciton came through the State Department of Health rating system.—Ed.)

A. E. GRIFFIN, Technical Engr., Wallace and Tiernan Co., a scheduled discussor, was unable to attend. His prepared discussion was highlighted by L. H. Enslow, of The Chlorine Institute, lantern slides revealing the behavior of several waters when partially and heavily chlorinated, in field and laboratory studies. The appearance of the so-called oxidation point, resulting from excess chlorine and contact peririods of 1 to 2 hours, was clearly in evidence. Taste and odor records on the same graphs revealed, as at Tyler, that chlorine intensifies tastes and odors up to the "break point" at which time oxidation is assumed to take effect. It is at and above such point that destruction of the taste producing elements takes place.

Mr. Enslow complimented Superintendent Lloyd and R. H. Presley (Chemist) for having perfected the seemingly bold scheme at Tyler before any of the recent work of experts had indicated the "why" of the scheme. The Tyler development proved the "eye-opener" that had encouraged investigations and trials of the method by others with similar successes in most instances.

**"Mapped Records For Water Systems"** by W. V. WEIR, Sup't., St. Louis County Water Co., University City, Mo.

Mr. Weir's talk was developed from the splendid contribution of the speaker (Chairman of A. W. W. A.'s Committee on Distribution System Records) in developing a standardized system of records for pipe lines, valves, etc. Mr. Weir pointed out that the cost and effort of keeping up-to-date mapped records was infinitesimal compared to the value of the scheme. For, said he, it must be admitted that a fitting or a valve unrecorded is a fitting or a valve lost. Mr. Weir's committee has produced a set of suggested standard symbols, for use on plats drawn to a scale of 100 ft. to the inch for small systems, 500 ft to the inch for intermediate, and 1000 ft. to the inch where the system is a very large one. Valve record plats had proved far the most useful and most used of the mapped records, every intersection having a separate plat in enlarged scale to facilitate exact location. Mr. Weir exhibited a surprisingly compact book of plats covering 66% of the extensive St. Louis County System (6300 valves and 500 miles of pipe), the scale being 500 ft. to the inch.

H. E. NUNN, Sup't., Van Buren, Ark., commented on the proven value of mapped records in easement proceedings.

W. F. MCMURRAY, Sup't., Tulsa, Okla., offered a valuable suggestion. He stated that any available map of the city may be reproduced cheaply by any commercial photographer equipped to produce a photo-lithograph negative. The latter serves well for making a pattern tracing for turning out black line prints.

## *Legal Responsibility*

**"The City's Legal Responsibility in Water Works Operation"** by H. P. KUCERA, City Attorney, Dallas, Texas.

Mr. Kucera reminded his audience that it had become an established fact that as long as municipalities collected for water on a utility basis the city could be held equally as liable as a private corporation for damages, and cited cases at point. On the other hand, it could be shown that the city was primarily selling a service, in that for the most part water supplied a customer was in effect only rented for use and returned to the city in the form of *used water,* to be disposed of as the next step of supplying a complete service. Further proof that water supply was a governmental function could be found in the fact that water income funds were frequently diverted to pay for other municipal services.

Mr. Kucera made an interesting reference to the role of water supply on the reputation of a city, far beyong its boundaries. He cited the importance of bad tasting water as having been responsible for unfavorable publicity to certain cities in the national press within recent times. [Mr. Kucera also revealed that after a long fight through the I.C.C. Texas municipalities had secured a rail rate reduction on cast iron pipe which is to save Texas cities $4.00 per ton on such pipe after December 22nd. —Ed.]

**"W. P. A. for Water Works & Sewerage"** by E. A. BAUGH, Director Public Works, Dallas.

Formerly W. P. A. State Engineer, Mr. Baugh commented that even with its faults the W. P. A. had been thoroughly worth while to Texas communities which had secured $6,203,000 in aid from the agency for water and sewerage betterments, principally in the smaller towns where most needed.

Mr. Baugh briefly explained the new and markedly improved method now available for prosecuting W. P. A. projects. The so-called "W. P. A.-Contract Plan" makes it possible for the project to be let to contract in the regular manner. In this scheme W. P. A. provides funds for certain labor and materials; the contractor manages the job, the City inspects it; and W. P. A. performs a certain oversight to see that regulations are complied with and that acceptable work is done. Thereby the old force account evils are done away with and the cost of the finished project can be accurately predicted.

L. H. ENSLOW called attention to the successful adaptation of the "W. P. A. Contract Plan" already at several points. It had proved satisfactory to contractor and the designing engineers alike. (One case in point is that of Hoopeston, Ill., the method and results being described in the November issue of this magazine.—Ed.) Mr. Enslow also said that there were indications that something of the nature would be continued as a substitute for the P. W. A. As to whether there was any limit as to the size of projects acceptable for the plan he could not say. There

*(1) John A. Walker (and water is his product), Sup't. Water and Sewerage, Stroud, Okla., and Barney Brown, Sup't. of Water, Hot Springs, Ark.; (2) H. G. Bailey, Sup't. Water and Sewerage, Garland, Texas, and L. E. Livingstone, Mfgrs. Representative, Dallas; (3) V. V. Long, Cons. Engr., Oklahoma City, and Bert Sprangel, Sup't. of Water, Claremore, Okla.; (4) Homer Boudreau, Sup't. of Utilities, Purcell, Okla., and Prof. W. R. Spencer, Univ. of Arkansas, Fayetteville, Ark.; (5) Hayes Kuhns, The Leadite Co., Philadelphia, and W. V. Weir, Sup't.-Engr., St. Louis County Water Co., University City, Mo.*

were, however, indications that other means would become available to the larger cities for all water and sewerage betterments that could be made self-supporting enough to justify long term loans at low enough interest rates to make the net cost to the municipality no greater than was true under P. W. A. financing. Furthermore, there was ample evidence behind the scenes in Washington to indicate that muncipalities should be planning effectively and in readiness for any forthcoming financing assistance that the government might announce in advancing water supply and sewerage betterments in preference to other municipal improvements.

**"City Planning in Relation to the Water System"** by E. A. Wood, City Plan Engineer, Dallas.

Mr. Wood named the several reasons why proper city planning would enable the water works management to plan minor extensions and betterments, with some certainty and with ample time for making sound investments at opportune times. One was the effective use of park areas for reservoirs or other water or sewage structures. Mr. Wood revealed that Dallas is now working on a 6 year plan, such to be executed regardless of whether or not Federal aid is to be available. In brief, planning should proceed and if Government aid was continued so much more easily could it be put to prompt and fullest use.

**"Cast Iron Pipe in Long Time Service"** by Lester Long, Ass't. Gen'l. Sales Manager, American Cast Iron Pipe Co., Birmingham, Ala.

Mr. Long's paper recounted the long history behind cast-iron pipe which apparently sprung from the casting of cannon from cast-iron in 1313 in Ghent, Germany. There the earliest cast-iron pipes were discovered. Then came the famed pipes of Versailles (1685); of London (1746); of Philadelphia (1804); Baltimore (1819); New York and Detroit (1830; St. Louis and Richmond (1831), and so on. The durability of cast-iron pipe was emphasized by the history of the earliest pipes still in use. And, in several instances, these pipes had been reclaimed for re-use when replaced by larger pipes.

*R. M. Dixon, Designing Engr., Dep't. of Public Works, Dallas; B. G. Cole, Chemist, Monroe, La., Water Dep't.; C. C. Hays, City Chemist, Waco, Texas (Inventor of the Hays Process)*

**"Factors Affecting Efficiencies of Deep Well Centrifugal Pumps"** by E. O. Fabrin, Chief Engineer, Layne and Bowler Corp., Memphis, Tenn.

Mr. Fabrin's meaty paper opened with an interesting highlighting of the history of centrifugal pump development from the beginning up to now, and current conceptions of theory and practice in their design, fabrication and maintenance. Coming up to modern design, Mr. Fabrin stated that efficiencies of open impeller pumps were now very nearly equal to the closed types. Recent comparative tests between the two types of deep well pumps (open impeller units with varying clearances between impeller and casing; closed impeller units with varying clearance between wearing rings and impeller) indicated that for given increase in clearances over the range of 1/64th to ⅛ inch the efficiency drop of the enclosed impeller unit to be only about one-half that of the open impeller. More impressive than efficiency drop was the difference revealed in total gallons pumped over a period. Mr. Fabrin also presented data revealing a 50% greater load on thrust bearings of somewhat worn open impeller units. As the same time appreciable effect of wearing ring clearance on thrust load of closed impeller units was also in evidence.

An important question in connection with deep well pumping is "What is the permissible amount of sand that can safely be pumped with centrifugal units?" An attempt to answer involved test runs with sharp sand 8 to 10 one-thousands of an inch diameter. Based on wearing ring clearance measurements after pumping 15,000 gallons of sand in recirculated water, it was computed that a water containing 1.47 gals. of such sand in each million, would increase the clearance by 0.033 inch after 28 years of continuous pumping at 1 m.g.d. rate; or with 1 ppm. sand 40 years. Corrosivity of the water and true vertical pump shaft seemed far more important considerations. In the matter of corrosion, porcelain coated impellers and casings had proved effective in combatting corrosion and in raising initial efficiencies 3 to 4%. The weakness of the coating was the hazard of enamel crazing and shedding, whereupon marked efficiency loss results. In considering deep well pumps, therefore, it is more important to see that the guaranteed efficiency is such as can be maintained beyond the first year than it is to insist on high first year efficiencies, which may be produced through "tricks of the trade" and ingenuity of designers.

## *Private Fire Protection*

**"Policies of Handling Private Fire Lines"** by W. D. Masterson, Manager, Water Board, San Antonio, Texas.

Mr. Masterson reported that about half the cities of 50,000 and upwards in the southwest made some sort of charge for private fire protection service. On this topic he made reference to two outstanding papers—those by Robert Nixon (A. W. W. A. Journal, Dec. 1937) and Reeves Newsom (A. W. W. A. Journal, Oct. 1938). Calling attention to the wide variation in charges made by 100 cities, need for standardization was definitely evident. Such charge should be a combination of readiness

*(1) E. R. Parkhurst, Jr., and Jack Orr of Rensselaer Valve Co. (Louisville and Dallas, respectively); (2) Profs. O. M. Smith and Edward Stapley of Okla. A. & M. College, Stillwater, Okla.; (3) J. L. Horner, Sup't. of Water and J. E. Owen, Ass't. Sup't., Henderson, Texas; (4) Walter E. Lamb, Sup't. Water and Sewerage, George West, Texas, and R. W. Evans, Sup't. of Water and Sewerage, Uvalde, Texas; (5) E. M. Rollins, Southern Alkali Corp., Dallas, and L. H. Scott, Sup't. Water and Sewage Treatment, Oklahoma City.*

to serve and cost of inspection and maintenance. Detector meters should be read monthly, and billed accordingly if use is indicated other than for actual fire service.

The San Antonio schedule of monthly charges follow:

***Sprinkler Service***

| | |
|---|---|
| 4 in. line | $48.00 flat |
| 6 " " | $48.00 to $66.00 |
| 8 " " | $72.00 to $96.00 |

(In addition, a charge of 5 cents per sprinkler head for all in excess of 200 heads.) For A. D. T. alarm system a 10% discount is allowed on the whole bill.

***Flat Rates (Hose & Hydrants)***

| | |
|---|---|
| 4 in. | $ 80.00 |
| 6 in. | 96.00 |
| 8 in. | 150.00 |

For metered services a ready to serve charge of $32.00 is added to the bill. All costs for extensions and meters are paid by customer. When a customer demands a service line of diameter equal to the main passing the property he is required to pay cost of running the line to the nearest city main not less than 2 in. larger in diameter—i.e., if a 6 in. line is demanded it must be run up to connect to the nearest main of 8 in size or larger.

**"Fire Service Experiences and Practices in Houston, Texas"** by G. L. FUGATE, Chief Engineer, Water Department, Houston, Tex.

Mr. Fugate in commenting on the need for some form of detector meter and routine inspection of private fire services revealed experiences in Houston which have led to the recent metering program of all open type services. Detector checks, with by-pass meter and check indicators, are employed where separate meters measure the supply for uses other than fire service. Meters of the fireflow type are used where the different uses are combined through a single service line. Through 14 such services 572,080 gallons per month of heretofore "unaccounted for water" can now be accounted for. The installation, needless to say, proved profitable as well as re-assuring.

Based upon this experience and the fundamental concepts of rate making, the following conclusions had been reached:

(1) Private fire service, a specialized "readiness to serve" service, should be paid for as such.

(2) *All* open types of fire service should be metered.

(3) Experience indicates that the closed alarm type of system will function without undue water waste if the Water Department installs a detector meter and makes frequent inspections. The added inspection cost should be added to the standby or ready-to-serve charge.

*E. O. Fabrin, Chief Engr., Layne & Bowler Corp.; Owen Rice, Research Engr., Calgon, Inc., Pittsburgh, Pa.; Dale L. Maffitt, Manager, Water and Sewage Dep'ts., Des Moines, Iowa.*

**"Unaccounted-for Water"** by R. B. THOMAS, City Engineer, Highland Park, Texas.

Mr. Thomas revealed routine methods employed by Highland Park in successfully reducing unaccounted-for water to 11%. The most dependable method of checking was that of districting the system and metering into the valved off (cut out) section through a bypass from hydrant to hydrant around the closed valve and the careful follow-up with the aqua-phone to locate leaks if the record justifies. In meter maintenance, domestic meters are tested every 4th year and larger meters are field checked yearly at least. Mr. Thomas exhibited a home-made aqua-phone consisting of a collapsible steel rod with old style telephone receiver attached. It had proved worthy in locating small leaks up to 150 ft. away, and had proved more effective than more expensive equipment tried.

J. L. HORNER, Sup't. of Water, Henderson, Tex., was of the opinion that all but about 6% of the water metered into the system should be accounted for, provided that all service lines to the meters were of modern corrosion resistant materials and meters had been check tested in service for proper size and accuracy. He cited a recent survey of 21 cities, revealing an average of 83% water accounted for with 92% the maximum, representing a decided improvement since earlier surveys.

## *Submerged Combustion*

**"Submerged Combustion for Recarbonation"** by L. H. SCOTT, Sup't. Water and Sewage Treatment, Oklahoma City, Okla.

Mr. Scott's paper described experiences in developing the novel scheme of recarbonating softened water by under-water gas burning—i.e., "submerged combustion." (It was for this development and the Scott-Darcey process of producing ferric chloride from scrap iron and chlorine that Mr. Scott was voted the Geo. W. Fuller Award of 1939 earlier in the meeting—Ed.)

The under water burners and gas-air control equipment at the Oklahoma plant was supplied by the Ozark Chemical Company of Tulsa, which company employs under-water gas burning as a method of evaporating sodium sulphate. Essentially the equipment consists of an air blower and gas feed line delivering air-gas mixture in proper proportions, in the proportioner-mixer, for complete combustion. From the mixer the mixture flows to the submerged burner, consisting of a very heavy walled steel cylinder with a conical bore. That at Oklahoma City is 5" in diameter, and has a capacity of 2,000 cu. ft. of natural gas per hour. If the flame goes out for any reason an alarm signal sounds and a solenoid valve shuts off the gas. To start the burner it is only necessary to turn

*(1) N. J. Kenny, President, National Meter Co., New York City; (2) Henry E. Nunn, Sup't. of Water, Van Buren, Ark.; (3) B. E. McDonald, Sup't. of Water, Ozona, Texas; (4) Walter Friedrichs, W. & T. Co., Houston; (5) N. G. Winder, Layne-Texas Co., Dallas (John B.'s boy); (6) R. H. Presley, Chemist, Water Dep't., Tyler, Texas.*

on the gas and press a button to secure the igniting electric spark. The great energy change, at the point where the burned gas ($CO_2$ + Nitrogen and excess air) leave the burner to enter the water, causes the gas to divide into countless minute bubbles which is ideal for absorption and rapid reaction.

The advantages listed, by Mr. Scott, for the method over conventional methods of recarbonation are (1) controllability; (2) simplicity of equipment; (3) trouble-free operation; (4) elimination of gas cooling and scrubbing equipment; (5) elimination of diffusers and corrosion troubles; (6) reduced maintenance. Concerning costs, he reported such to be equal to or less than present costs, the scheme being suited to installation and operation in existing plants, without interruption of plant operation. (For further details of the method and equipment, see the article by Messrs. Scott and Abbot in WATER WORKS & SEWERAGE for October, 1939.—Ed.)

L. H. ENSLOW, who had seen the scheme in operation during development last year, remarked on its impressiveness in several directions. To talk about burning gas under water sounded fantastic, but there it was right before one's eyes. Not the least impressive was the simplicity of the whole thing, and maintenance economy.

**"Cutting Cost of Operation and Maintenance"** by W. F. McMURRY, Sup't. of Water, Tulsa, Okla.

Mr. McMurray stated that never before has the public demanded more emphatically that business methods and greater efficiency be put into governmental enterprise. Therefore, never was the time more appropriate for selling governing boards and the public on the idea that political influence should be completely and permanently removed from the Water Department and its operation henceforth placed on a strictly utility management basis.

In meeting the latter requirement, Water Departments must be considered as the "Industry of the Public." Operating with obsolescent equipment could never pay dividends and the matter of advanced budgeting should receive more attention. Likewise, plans for purchase of equipment based on anticipated long term economy rather than immediate necessity or initial costs, book value, etc.

*Dr. B. B. Harris, Dean North Texas Teachers College, Denton, Texas; Thomas C. Green, Sup't., Water and Sewage Treatment, Austin, Texas; Henry M. Robinson, Dallas Water Dep't.*

**"Operating Conditions of a Water Works"** by L. A. JACKSON, Manager, Water Department, Little Rock, Ark.

Mr. Jackson showed a most praiseworthy movie of the water supply properties and activities of the Little Rock Water Department personnel. The movie was made expressly for the purpose of acquainting Little Rock citizens, civic ciubs and school children, with the functions of plant units and equipment, and employees. It was an outstanding job of amateur photography, the film having been produced at a total cost of $342, of which $200 represented the cost of preparing captions and having a publicity man write the continuity. It had proved a very much worth while investment in building public interest, said Mr. Jackson. (We would add—and also for showing before water works associations and in acquainting all department employees with what the other fellow's job is like.—Ed.)

In a running talk, Mr. Jackson revealed that Little Rock has one man continuously employed on hydrant inspection and maintenance, getting to every unit at least 3 times per year. Cleaning 10 miles of 40 year old 16 in. main had increased its capacity 70% affording a 6 mgd. increased flow into the heart of the business district. Between the new dam and the purification plant (32 miles) communication was had over short wave radio. The Department maintains children's showers at 16 locations in the city as a public relations enterprise. Billing machines have been amplified to show discounts, sales tax, and now sewer rental.

**Handsomest Conventioneers**

*O. V. Lindell, The Dorr Co., Kansas City, Mo.; S. H. Newland ,Ass't. Engr., La. State Dep't. of Health, Shreveport; Jack Kelly, Carco Corp., New York, N. Y.*

**"Water Needs of Texas and the Southwest"** by V. M. EHLERS, Chief Engr., Texas State Dept. of Health, Austin, Tex.

Mr. Ehlers, in discussing the problems of water supply in Texas, emphasized the growing seriousness of salt water contamination of important ground water supplies as well as surface supplies—of the latter the supplies of Beaumont and Port Arthur being affected. Responsible for ground water contamination, the casings of abandoned oil wells had been found corroded through and releasing salt water into the fresh water strata. Texas with 88,000 oil wells is faced with a real problem, more so as time and casing corrosion advances. From this difficulty the 18 mile inland well-field of the Galveston supply had been recently suffering an increasing salt content, attributed to an oil field 3 miles distant.

Mr. Ehlers pleaded for some concerted action by the water works fraternity in efforts to safeguard the water supplies of the state. The Department of Health now had 4 men devoting full time to surveys and studies of this one problem on which the oil producers had already spent millions of dollars for waste ponding and release during high run off. Another procedure involved putting down return wells which cost $125,000 each—an effective but expensive method.

In Texas more softening and iron removal was needed, and the sulphide waters presented another problem. Tastes and odors in surface supplies continued to be one of the chief problems and wholly satisfactory corrective methods in many instances had yet to be developed. In sewage treatment and water supply betterments it was felt that numerous dams, for stream impounding and controlled release, would relieve cities of considerable expense in constructing and operating high degree treatment works.

*Prof. W. M. Longnecker, Southern Methodist Univ., Dallas; R. B. Thomas, City Engr., Highland Park, Texas; O. M. Baake, Director, Houston Laboratories, Houston.*

**"Stream Pollution Control in Texas"** by CHESTER COHEN, Prin. Ass't. Engr., State Dep't. of Health, Austin, Texas.

Texas, boasting the largest number of sewage treatment plants of any state (440) can apparently also boast the highest ratio of treated sewage of any state. This may be taken from the statement by Mr. Cohen, that only 15 incorporated towns of Texas now discharge untreated sewage into streams; and only 9 into coastal waters.

As yet not such a satisfactory picture could be presented for industrial pollution, which now equalled the original domestic loading on Texas waterways. Wastes from meat packers had been a problem of increasing magnitude. Next in importance, the wastes of the citrus industry in the South, there being 90 plants contributing wastes 70 times the strength of domestic sewage. He also touched on the salt water pollution from the oil industry (500 mgd.) which Mr. Ehlers emphasized as more important in water supply than as a nuisance problem.

Mr. Cohen revealed that the Department is working with manufacturer's groups and associations in studying and developing methods of pollution alleviation, emphasizing recovery as far as possible. In respect to advancement of sewage treatment, Short Schools for Sewage Works Operators conducted by the Department of Education (many being night schools), had been serving a splendid purpose.

## *Other Papers*

Additional papers, which space does not permit effective reporting of, were the following:

**"The Mineral Composition of the Waters of Oklahoma,"** by DR. O. M. SMITH, Head of Dept. of Chemistry, Oklahoma A. & M. College, constitutes a compendium of valuable statistical information on water quality from various Oklahoma sources of supply, both surface and ground waters. It was evident that many supplies in the state are sorely in need of softening or otherwise treated to improve their mineral and corrosive qualities. The survey recently completed is the second and gives a picture of changes in qualities over a five-year period intervening since the earlier survey.

**"Resources of the Southwest—Their Development"** by DR. E. P. SCHOCH, Director, Dept. of Chemistry, University of Texas, constituted a discussion of the three natural resources of Texas—Mineral; Biological, Human. His theme was "Industrializing Texas for Texans" in which he emphasized the need for less exportation of raw materials and their greater conversion into manufactured products within the state. For that end—less lawyers and more technicians.

**"Biological Balance for the Control of Tastes and Odors"** by DR. B. B. HARRIS, Dean, North Texas State Teachers College, Denton, Tex., constituted a plea to water works men to stop using chemicals or other artificial measures for controlling algae propagation and subsequent degradation of impounded waters. Instead, to seek biological balance as the control provided through the centuries by Nature. (All of which sounds splendid to one dealing with "Aqua-Culture" in a laboratory aquarium. However, Dr. Harris' suggestions and prerequisites seemed to be rather difficult formulae to meet on a water supply reservoir scale. Therefore, what looked on the program to be a possible "Answer to a maiden's prayer" proved a disappointment when it came to considerations of practical application.—Ed.)

Dr. Harris' paper was amplified by Dr. J. K. Silvey, an associate, and was discussed by Dr. W. M. Longnecker, Professor of Biology, Southern Methodist University, Dallas—the latter pointing out a few practical considerations which he felt would hardly justify discarding present known man-made relief methods or the use of chemicals, for sometime to come.

*Prof. J. K. Silvey, Denton, Tex., North Texas Teachers College; George B. Gascoigne, President, Gascoigne & Associates, Cleveland; E. L. Filby, Black & Veatch, Engrs., Kansas City, Mo.*

## *Exhibitors*

The following 32 firms displayed materials or equipment, the largest number ever to exhibit at a Southwest meeting:

American Cast Iron Pipe Co.
Atlas Mineral Products Co.
American City
Badger Meter Mfg. Co.
Calgon, Inc.
Fairbanks Morse & Co.
Flexible Pipe Cleaning Co.
Hersey Mfg. Co.
Fred W. Hanks Co.
Hays Manufacturing Co.
Homelite Corp.
Hydraulic Development Corp.
Industrial Chemical Sales
Iowa Valve Co.
International Filter Co.
Johns-Manville Corp.
McWane Cast Iron Pipe Co.
M. & H. Valve Fittings Co.
Mueller Co.
National Cast Iron Pipe Co.
National Water Main Cleaning Co.
National Meter Company.
Neptune Meter Co.
Pittsburgh Equitable Meter Co.
Rensselaer Valve Co.
Southern Alkali Corp.
U. S. Pipe and Foundry Co.
Water Works Engineering
Well Machinery & Supply Co.
R. D. Wood Company
Wallace & Tiernan Co.
Water Works & Sewerage

# PRIMING CENTRIFUGAL SEWAGE PUMPS

## An Improved Automatic System That Has Proved Meritorious

The Author

By H. V. PETERSEN, General Sales Manager,
De Laval Steam Turbine Co.
TRENTON, N. J.

THE priming of centrifugal pumps handling sewage presents difficulties, both because of the clogging propensities of the fluid and its corrosiveness. Locating the pump in a dry pit below the level of the sewage chamber is generally expensive, and often not at all practicable. Submerging the pump in the sewage is not desirable, as parts which need attention at regular intervals, such as the steady bearing and the shaft packing glands, are not then accessible, and the only way in which the pump can be overhauled is to disconnect it and lift it out of the sewage chamber, after which it must be moved outside of the building and cleaned with water from a hose before it can be taken apart. Even then men usually object to working on such pumps.

### *Economic and Practical Considerations*

A vertical shaft pumping unit is generally more costly than is a horizontal unit, because a vertical shaft motor costs more than does a horizontal shaft motor and the casing and other parts of the pump are special. Furthermore, cost of suction intake and of pump and motor foundations for a horizontal pumping unit are less than for a vertical unit, so that the saving in the cost of the horizontal pumping unit generally is more than sufficient to cover the cost of effective priming equipment. Therefore, a standard horizontal pump with an automatic self-priming system is of practical and economic interest.

Centrifugal sewage pumps have in some cases been primed by a continuously running vacuum pump, driven from the main pump shaft and sealed with clean water. In such installations an air inlet valve, operated by a float in a priming chamber, is employed to admit air in order to prevent the air pump from drawing over sewage, which would clog it and put it out of action. In spite of this precaution, however, an air pump connected in this manner is always in danger of clogging and, moreover, to have the air pump running continuously, regardless of the necessity of removing gas from the suction of the main pump, consumes an appreciable amount of power—namely, ¾ to 3 horsepower. There is also a continuous consumption of sealing water and, unless special precautions are taken, there is danger that sewage contamination will work

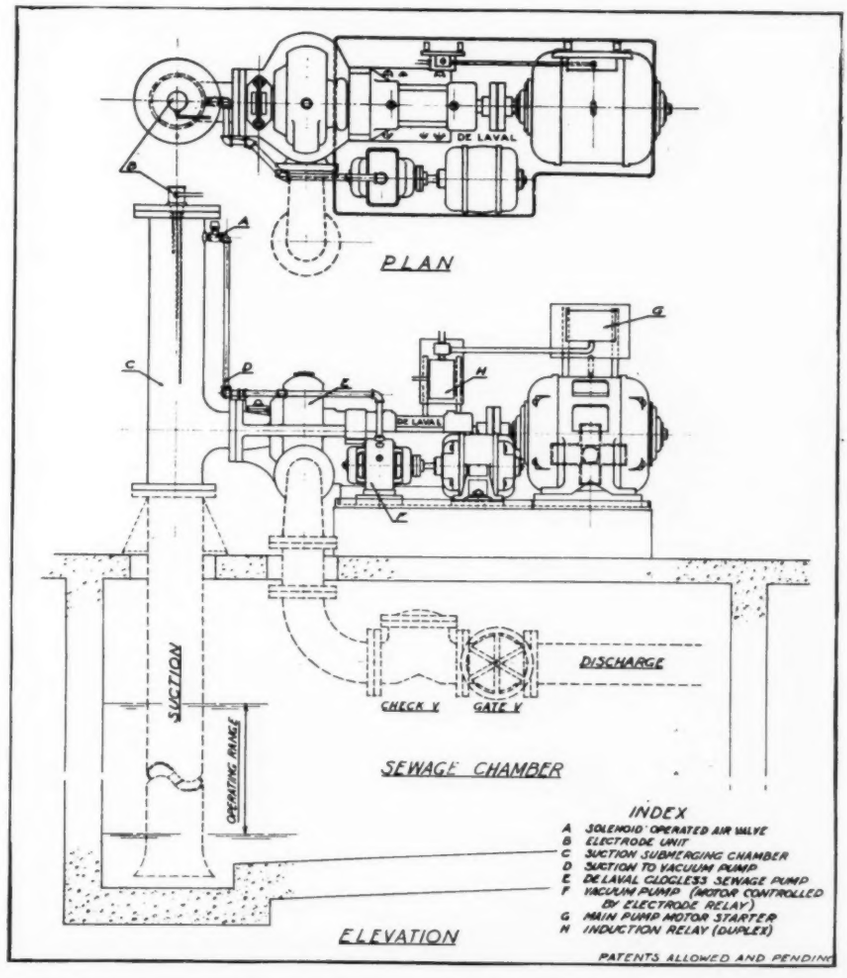



**Fig. 1.—De Laval Submerged Suction Priming System for Individual Pumps**

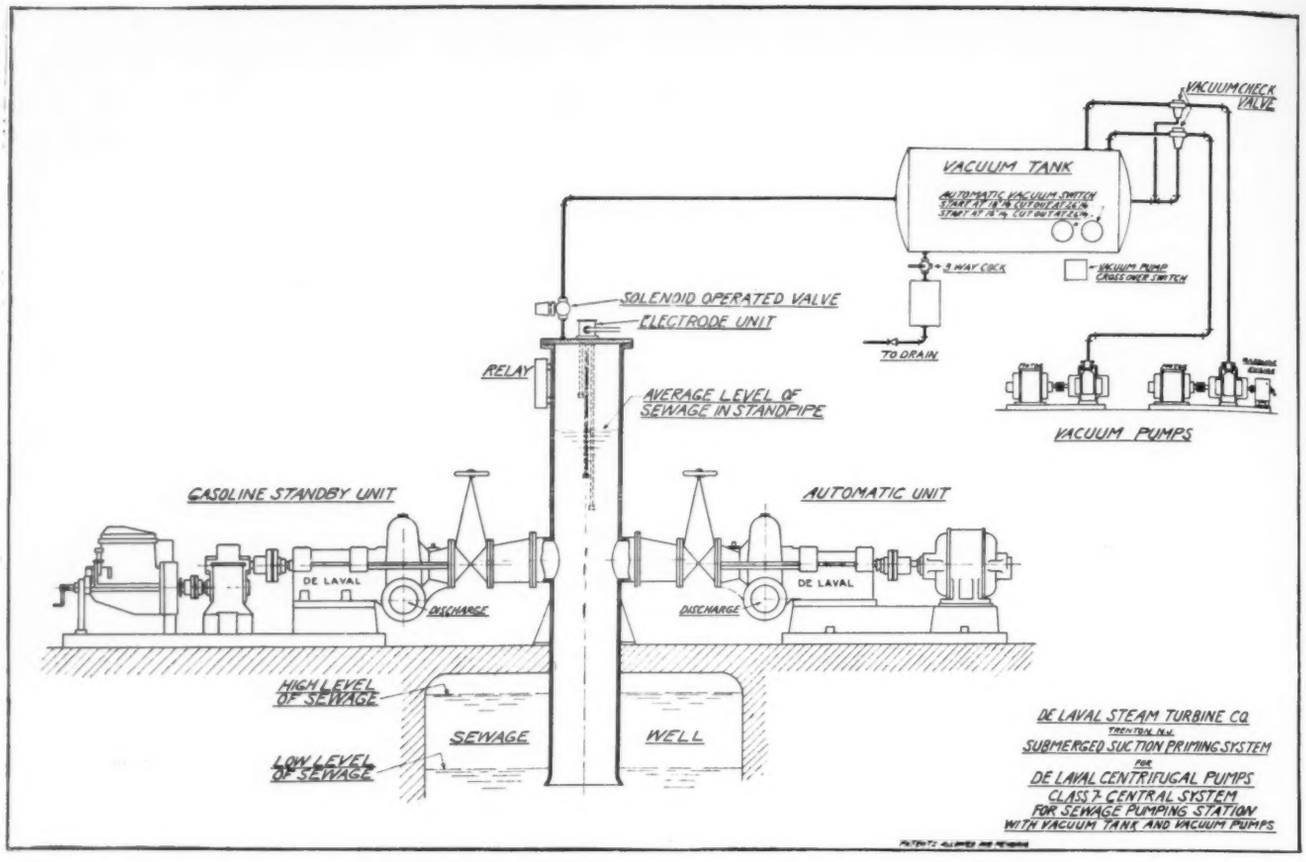



**Fig. 2.—De Laval Central System for Submerged Suction Priming in Multiple Pump Installations**

back into the water supply system if the pressure therein should fail even momentarily.

## *An Improved and Trouble-Free System Developed*

In the De Laval submerged suction priming system for centrifugal pumps, herewith illustrated, the liquid level on the suction side of the pump is continuously maintained above the pump impeller suction opening and the small motor-driven vacuum pump (oil sealed and air-cooled) is operated only intermittently, as required to hold the sewage at that level. During such periodic operations it takes only ¾ to 1½ hp., depending upon the size of the unit, the suction lift and the length of the suction line.

The vacuum pump, as also the main pump, is started and stopped by induction relays mounted upon the starting boxes of the vacuum pump motor and of the main pump motor, and is actuated by three electrodes in the submerging chamber (see cuts). These electrodes are covered by perforated bakelite sleeves and function reliably regardless of the character of the liquid or of suspended material which might interfere with the action of floats. Except for the submerging chamber, which should be of a size equal to or larger than the main pump suction line, no change is made in the arrangement and piping of the main pump, which is connected to the force main through the usual check valve and gate valve. The air suction line which leads to the vacuum pump takes off from the top of the submerging chamber at a level not reached by the sewage, and is provided with a spring-closed solenoid valve.

### *The Cycle of Operations*

The priming and pumping operations begin when a switch in the main line circuit is closed, either manually or automatically. When this occurs the main sewage pump does not at once receive current, but the vacuum pump starts immediately and continues in operation until water reaches the topmost of the three electrodes in the submerging chamber. Thereupon the solenoid valve in the vacuum pump suction line (see cut) is closed and the vacuum pump shut down. Only then is the motor driving the main sewage pump started in the sequence arrangement.

### *Safety Features*

As sewage generally gives off gases (particularly when under reduced pressure), the liquid level in the submerging chamber may drop progressively as pumping proceeds, until the upper electrode and ultimately the middle electrode is uncovered. However, as soon as the middle electrode is bare the vacuum pump again automatically starts and the solenoid valve in the vacuum line opens. But if by reason of any failure of the vacuum producing apparatus, or of an excessive amount of air or other gas entering the suction line, the level should continue to fall until the third or lowest electrode is uncovered, the main pump will automatically be shut down until priming is reestablished. In case the main circuit is opened, either manually or by a float actuated by drop in level in the sewage chamber, the auxiliary circuit to the electrodes and vacuum pump is at the same time opened in order to save pumping at times when the main pump is not needed, but when the main circuit is again closed priming operations are initiated in the same sequence as before.

There are no surges in the submerging chamber on the suction line, regardless of how often the vacuum pump or the main pump may be started or stopped. This is explained by the fact that an upward surge would increase the air pressure above the water, while a down ward surge would reduce it, thus counteracting the force causing the surge just as air chambers for such purpose do.

***Multiple Pump System***

Where there are a number of pumps in the same plant, it is not necessary to provide a separate vacuum pump for each main pumping unit. Instead, a vacuum line leading from the top of the submerging chamber can run to a central vacuum tank wherein a constant vacuum is maintained by one of two vacuum pumps, one unit serving as a standby and arranged to come into service when the vacuum falls below a predetermined point. In the multiple unit system the electrodes in the submerging chamber control only the solenoid valve in the vacuum line and the starter of the individual sewage pump and do not affect the vacuum pumps serving the central vacuum chamber, which are in such instance under control of a diaphragm operated vacuum switch to insure maintenance of a partial vacuum up to each individual solenoid valve continuously.

## Sludge Gas to Run British Automotive Equipment?

Owing to the scarcity of petrol (gasoline to you), and exigencies of the war, England has been looking to substitutes for operating automotive equipment. Amongst the most promising are gases which can be most highly compressed.

The latest gas to be considered is sludge digestion gas, as is indicated in a short account that appeared recently in the *London Times*, captioned—

**Methane Gas for Cars**

Approval was given yesterday to a scheme of using surplus methane gas, procured from sewage sludge digestion, as a substitute for petrol for local motor-transport vehicles. It was estimated that over 300,000 gallons of petrol could thus be saved in a year by utilizing the gas from the sewage treatment works at Mogden (London suburb) alone.

The 150,000 cu. ft. of Mogden gas (70% methane) is considered equivalent to 700 gallons of petrol per day. Two compressors for storing the gas under pressure and filling gas cylinders on the motor vehicles are to be installed immediately as the first trial unit.

According to the British report, Germany already has over 1000 vehicles operating on compressed methane gas. Dr. C. M. Walker of the Birmingham Gas Department, who is the British expert on the operation of motor vehicles by compressed gas states that, as a practical and economical proposition, sludge gas containing 70% methane, has great advantages over town's gas, because of its higher power value per volume and its anti-knock properties.

(For this information we are indebted to "Uncle Billy" Russell, who represents The Dorr Company in London.—Ed.)

## Novel Use for Digester Gas

We understand that the City of Stuttgart, Germany, is running some of its automotive equipment on gas from the local sewage works.

In a recent U. S. Dept. of Commerce Report, a statement is made by the American Consul to Germany to the effect that in 1938 approximately 1,000,000 cubic meters of the purified digester gas was employed in motor vehicle generation, the savings effected in fuel costs having already paid for the conversion from gasoline to gas consuming units.

It is not clear as to just how the scheme operates but it seems apparent that it involves a gas purification, drying and compressor station and the filling of gas pressure cylinders for replacement of empties on the trucks, etc.

In Germany such a scheme may pay, but in America where gasoline is not at such a premium we gravely doubt that gas purification and its compression and packaging for automotive use can compare economically with local power development and heat recovery for plant usage with gas engines—any surplus possibly going to other municipal uses. In any event Stuttgart has recovered a different "squeal" from the by-product "pig."

(This item was prepared for use in an earlier issue but proved a "misfit" in previous issues. In view of the recent British development, recounted elsewhere in this issue, we are belatedly running this account also.—Ed.)

## Providence to Have Water Supply Board

Under the new City Charter of Providence, R. I., the Water Department is to be controlled and managed by a Water Supply Board under which the Department will function as a utility, freed from political power or interference.

The new Board will consist of four prominent and civic minded citizens, who will serve without compensation, as members. The City Treasurer becomes an ex-officio member of the Board, the other members' terms being staggered to run for 4 years each.

The Board will have full authority to appoint a Chief Engineer of the Water Board, whose term shall be not more than four years between reappointments. He must be a recognized civil or mechanical engineer, with at least 5 years water supply experience. His tenure is carefully protected by stipulations as to hearings before he can be dismissed by Board action. The Engineer becomes in reality the Engineer-Manager, with full authority over the complete water supply system, embracing collection, storage, purification and distribution.

Interesting is the fact that Providence earlier had a Water Supply Board. Familiarity with its advantages, while serving as a member of the former Board, probably led the present Mayor, Joseph H. Gainer, to recommend the change to the Providence Charter Revision Committee which he served as secretary.

The present Superintendent of Water at Providence is Philip J. Holton, Jr., a proficient engineer, who without much question will be continued as such by the new Board.

# EXPERIENCES AND OBSERVATIONS

"Len"

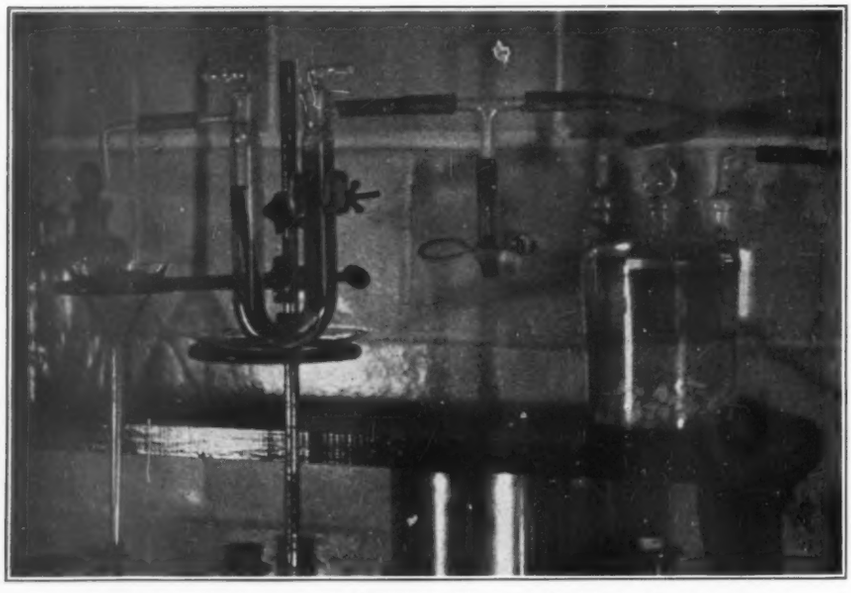
## *With an Idea That Some May Be Novel*

**From F. L. COVENTRY, Chemist**
**WATER DEPARTMENT**
**MATTOON, ILLINOIS**

Dear Bob:

I was talking to Jim the other day over at his place and he showed me the letter you wrote him recently. Well, it sure does beat all, but I am having a baffling experience, too. I was feeding about 1 ppm. of pre-chlorine with sulphate of ammonia and producing a filter effluent showing 0.3 ppm. residual, yet complaints of taste and odor were frequent and high counts appeared in the clear well samples, and no residual chlorine could be found out in the distribution system. I doubled the pre-chlorine feed which resulted in a 1 to 4 ratio chloramine, but got no better results. One day we were actually feeding 10 ppm. chlorine, and two miles away from the plant there was only a trace of residual, but plenty of odor complaints which I termed musty. You will say, "Where did all that chlorine go?" We think we know now, but it was a puzzle for a time.

Complete analysis of the filtered water showed 1.9 g.p.g. of organic matter. This figures 16% of the 8.5 g.p.g. total dissolved solids. Was I dumfounded? Well, I assumed that the high pH to which we must go in securing effective softening was reducing the oxidation potential of the chloramines too markedly. So I went to pre- and post-chlorination, feeding chlorine into both the mixing tank and pump suction. At the same time I switched the feed of ammonia sulphate into the filter influent. Soon after this change our filtered water showed less than 0.5 g.p.g. of organic matter—about a 65% reduction. But I still have to feed 1 ppm. additional chlorine to the finished water to produce a chlorine residual in the far ends of the distribution system. Maybe, you, too, are passing considerable organic matter through your plant. It looks like chlorine, minus the ammonia, will sure "burn it out."



**Enslow's Continuous Stability Indicator (Mattoon Modification)**
*It really does "work while you sleep" as the inventor claims. On the left we have added a steel wool corrosion detector, with white drip plate, for running in parallel or in series with the Stability Indicator as a double check on treatment control.*

### *We Like Our Continuous Stability Indicator*

I am sending you a picture of my Continuous Stability Indicator. Bet Linn Enslow would like to see it, because I have changed his design a little. You can see the calcium carbonate incrusted filter sand in the Woulff bottle on top of the crushed limestone. (I have plenty to spare you, if you want some—the sand I mean.) There on the surface of the sand the powdered calcium carbonate is not clearly visible. The water flows continuously down through this material, thence over to the U-tube. (Sampling cock in this line is for "marble test" of water through $CaCO_3$ in bottle.) I put some steel wool and some 16 penny nails into this tube. I think you can see the little white porcelain spot plate in the funnel. The effluent from the U-tube drips onto this plate, staining it red if the effluent contains any dissolved iron. It's just like Enslow says, it "works while you sleep." And, maybe he will call step No. 2, "wire nail chemistry"—but it really tells the story.

### *A Painting Kink That Works*

You remember what an awful time we had in making our elevated wash water tank look nice. Recall how the paint scaled and peeled? Well, some fellow told the "big boss" that raw linseed oil would prime the metal surface so the aluminum paint would stick. So some of our W.P.A. boys scraped and wire-brushed the tank and painted raw linseed oil on it. Of course, it took several weeks for the oil to dry or solidify, but fortunately, we weren't in any hurry. The two coats of aluminum sure do shine. Boy! You should see it. It is just as bright and free from scale as the day it was painted.

### *Free $CO_2$ That Is Free*

I was over to see Fred the other

day. He is real proud of himself now that he is operating his lime-soda softening plant by "recarbonating" with his carbon dioxide bearing well water. He has two mixing tanks, a slow mix and a quick mix. So he puts 75% of the plant flow through the quick mix with 580 ppm. lime and 8.5 ppm. of alum treatment. This mixed water exhibits an alkalinity of 105-135, (75 ppm. caustic), and a pH 10.8, thus allowing the magnesium to be precipitated as the hydroxide. The effluent from this tank flows to the slow mix where the 25% untreated water is added. This added water has a M.O. alkalinity of 410 with 80 ppm. free carbon dioxide (which is really free in respect to cost) and a pH 6.9. After this is stirred into the over-treated water in the slow mix, the settled water shows an alk. of 24-95, (hardness 70) and pH 8.8. The sodium bi-carbonate present in his well water makes the alkalinity higher than the hardness. Oh, yes, he is still feeding "Calgon" to stabilize this water. He says he is using only 0.75 ppm. and doing a good job of it, too. After messing around with a coke-burning stove to produce carbon dioxide, he is glad he doesn't have to clean compressors, etc., anymore.

### *A Water Cooler Gets "Hexed"*

And I wanted you to see Fred's Hexametaphosphate feeder. Sure looks funny to see this water cooler in the filter room. He loaned me this picture of it to send you and I promised him you would send it back. So, please do. A Hancock flow control valve is screwed onto the outlet and you can see for yourself that he has a constant head of about 6 inches on this valve from the "cooling pot" of this feeder. The valve has 30 graduations marked so he has that many rates of feed for the same concentration of solution. He puts 3 pounds of "Calgon" into a 5-gallon crock, stirs it until it is dissolved and then it is ready when the jug on the "cooler" runs empty. He has the concentration so that he opens 2 marks on the valve for each filter in operation.

### *Joe Has Turned No. 1 Drink Mixer*

I wish you could see Joe dancing around now. He sure knows now that the guy who said "It's an ill wind, etc.," was right. You and I always thought that the permanent or non-carbonate hardness of surface waters was a "pain-in-the-neck" because we had to either use soda ash or leave it

**An Ordinary Water Cooler Proves Satisfactory Calgon Feeder**

in solution to increase our total hardness above that represented by alkalinity. Now Joe comes along with his idea of mixing his two sources of supply for treatment. The impounding reservoir water has been running about 180 ppm. M.O. alkalinity and 65 ppm. non-carbonate hardness all summer. His ground water supply has a M.O. alkalinity of 450, hardness 360, 96 ppm. of sodium bi-carbonate in solution. Joe has been mixing the surface water and the ground water 50-50. And why not? He has a perfectly good solution of soda ash when he adds lime to his ground water. I told him what Fred was doing in regard to using ground water for re-carbonation, so he is now doing that, too. I am sending you a copy of the analysis he recently made on his filter effluent. Look it over, big boy, and you will see why the ice manufacturers in his town rise up and call him blessed. The beverage bottlers are more than pleased because the sodium carbonate alkalinity formerly in the water is now absent. This alkalinity destroyed some of the flavor, zest and twang of the beverage since it neutralized part of the organic acids in the beverage syrup. Joe gave me a bottle of Coca-Cola, and it sure did taste different from that 'coke' which I have been accustomed to drinking. You'll be interested in knowing that one of the bottling concerns over in Joe's town sent a sample of the city water in to the headquarters laboratory of his company and they accused him of sending them a sample of distilled water. Is it any wonder that Joe is happy? Boy, wouldn't we all like to have water in our mains of such quality that the total dissolved solids are under 9 g.p.g.?

CITY WATER
Kickapoo Plant Effluent

| | Supply From:— Wells— 100% | Wells & Lake 50/50 |
|---|---|---|
| *Hypothetical Combinations* (PPM.) | | |
| Iron and Alumina | 0 | 0 |
| Sodium carbonate | 52 | 0 |
| Sodium chloride | 148.5 | 44 |
| Sodium sulfate | 13 | 19.5 |
| Magnesium sulfate | 0 | 8.1 |
| Magnesium carbonate | 44 | 12.4 |
| Calcium carbonate | 37.5 | 50.0 |
| Silica | 17 | 13 |
| Total solids | 312.0 | 147.0 |
| Hardness as $CaCo_3$ (calculated) | 90 | 71.7 |
| pH | 9.2 | 7.6 |

### *Improving Main Sterilization*

I suppose you want to know what we are doing now about our new water mains in the matter of sterilization since you laughed at me because I had such a gosh awful time with that 8-inch main over on B avenue last summer. I sure appreciate the loan of your portable main sterilizer for those 7 awful weeks of loss of sleep before the samples showed negative in 10 ml. portions. Well, here is what we have been doing lately. It is my thought that the chief offender in cases of prolonged contamination of a pipe line is the jute. In addition to our 0.3 pound of HTH or Perchloron per 100 ft. of pipe (which gives about 10 ppm chlorine in a six inch main) we go a little further now. Five grain gelatine capsules are purchased from the local drug store and filled by us with a soluble hypochlorite. For a 6 inch pipe, three of these 'pills' are used in each joint, one pill for each 6 inch of pipe circumference. Thus, in an 8 in. pipe you should use 4 pills per joint. These pills are spaced at intervals around the joint by entwining them in the jute itself. If the yarning tool happens to break one or two of them, what the heck? The powder is where you want it by that time. When the water is turned into the pipe line, the gelatine dissolves, leaving the concentrated hypochlorite in immediate contact with the fibers of the packing material. To date we have laid a couple miles of main in five sections of our distribution system as described, and we have had five minus samples in every case within 24 hours after the main was flushed and allowed to re-fill.

I had better sign off before I have to pay excess postage on this letter.

Yours etc.,

"Len."

# "THE HARDEST NUT CAN USUALLY BE CRACKED"

## A Three Act Playlet*

By D. R. TAYLOR, Plant Superintendent
Roanoke Water Department
ROANOKE, VA.

PLACE: Any Water Department office.

TIME: Any day—usually just before closing time, after you have had an unusually busy and trying day that has left your nerves frayed and your patience near end.

### *Act I*

(Scene 1)

Tuesday afternoon—4:45 P. M.

[A customer enters the office with a rather quick gait and approaches a clerk.]

CUSTOMER: "I want to see the manager."

CLERK: "Why certainly. Will you please have a seat for just a moment? Whom shall I say wishes to see him?"

CUSTOMER: "What difference does that make? Do you have to be the President of the United States to see the manager here?"

CLERK: "Why of course not—just a moment please."

(Clerk retires to manager's office.)

CLERK: "Mr. Brown, there is a gentleman in the front office who wishes to see you."

MANAGER: "Do you know who he is, Miss Gray?"

CLERK: "No, I do not. When I asked him his name he asked if one had to be the President of the United States to see the manager here."

MANAGER: "Escort him in please."

(Customer enters manager's office.)

MANAGER: "Good afternoon."

CUSTOMER: "What do you people think you are trying to do down here?"

MANAGER: "I beg your pardon, I don't believe I follow you."

(Expression of consternation on the manager's face.)

CUSTOMER: "What is the idea of sending me such a bill? Do you think you are going to get away with that? Well I'll tell you right now that you are not—not for one minute. I've been living in this town for 35 years, and this is the highest bill I have ever received since I have been here, and it should have been the lowest. Now if you will make me up a correct bill for the water that I have actually used, I will be glad to pay it; otherwise I'm going right to the city council and show them just how the citizens of this city are being treated."

MANAGER: "Won't you please have a seat, and I will be delighted to try and find out what is wrong with your bill. I don't believe I have had the pleasure of meeting you yet."

CUSTOMER: "Smith is my name."

MANAGER: "How do you do, Mr. Smith. I am exceedingly glad to meet you. Do you have your bill with you, Mr. Smith?"

CUSTOMER: "Yes—here it is."

MANAGER: "Yes — $12.35 is rather above the average for a quarter. That would make your monthly bill slightly more than $4.30."

CUSTOMER: "I don't know what the average is, but my bill usually runs about $6.75 per quarter or $2.25 per month; and if you can't give me a correct bill, I'll just go up and see the mayor, because I don't intend to be robbed in any such manner. I don't wash my automobile at home; we send our laundry out; and I do very little lawn sprinkling. There are only four in my family; yet there are six in the family next door, and they do all of their laundering at home, and their bill only runs $6.00 a quarter. I have a brother that lives in Terryburg, and he tells me that his water bill doesn't run but $1.50 a month, and he has the same number in his family that I have in mine."

(Manager presses button for clerk; clerk enters office.)

MANAGER: "Miss Gray, will you bring me route book 27 please? Now, Mr. Smith, just one moment until I get the record of your account, and I am sure we will have no difficulty in locating the trouble."

CUSTOMER: "Well I don't expect to pay such a bill as that. I have known the city solicitor of this city intimately for 15 years, and if necessary I'll take this thing right to him."

(Clerk enters office with route book. Manager opens route book to proper account, which is shown by the folio number on the bill.)

MANAGER: "Now, Mr. Smith, let's look at the record here and see what we find. Your consumption for the last quarter was 34,000 gallons, and I note that for the past two years your average has been only 15,500 gallons or slightly more than 5,000 gallons per month, which is about the average for the homes in your section. I do not find any record here showing that you have previously asked for an investigation of this high bill."

CUSTOMER: "No, this is the first time I have said anything about it, and there is going to be an investigation before I pay it."

MANAGER: "Mr. Smith, are you sure that you have no leaks in your plumbing?"

CUSTOMER: "Not a single one—you can go out there and look if you want to."

MANAGER: "Mr. Smith, it will require a day or two for us to make the proper investigation of this apparent irregularity. May I ask that you leave your bill with me and also ask that you do not worry about this high bill until you hear from me, and you can rest assured that a very thorough investigation will be made,

*This playlet was put on by "Doc" Taylor—playright, stage director, actor — before the Va. Section of A. W. W. A. as a Public Relation skit to show how it might be done with just a bit of acting and a little detective ability mixed in. We think it a "Whiz".—Ed.

and the cause of this irregularity will be found. I wonder if it would be convenient for you to come in to see me sometime day after tomorrow."

CUSTOMER: "Yes, I can come back day after tomorrow about 3:30 P. M."

MANAGER: "That will be fine. Now please forget that you received this bill, and please do not worry about it until I talk with you Thursday."

CUSTOMER: "Before I pay such an outrageous bill as that I will spend $100 in court."

MANAGER: "Mr. Smith, I can assure you that we will locate the trouble, and please do not worry any more about your bill until I talk with you Thursday."

(Customer leaves office. Manager presses button for clerk. Clerk enters office.)

MANAGER: "Miss Gray, will you please make a work order to install the recording register on Mr. Smith's meter? Here is the route book, and this is his account. Will you please also tell John to see me before going out on this job?"

[Two hours later meter service man enters manager's office.]

METER SERVICE MAN: "Mr. Brown, Miss Gray said that you wanted to see me before I installed the recorder out in Clermont Heights."

MANAGER: "Yes, John, while you are at this location I wish you would keep your eyes open and see if you notice anything—what hobbies Mr. Smith has."

SERVICE MAN: "All right, Mr. Brown, I understand."

(Meter service man leaves office.)

### Act 1—Scene 2

[Thursday morning the manager receives the recorder chart from the meter service man with certain penciled notes attached. In the meantime the Manager has looked over the route book to see if he knows anyone living near Mr. Smith.]

SERVICE MAN: "Mr. Brown, here is the chart from Mr. Smith's home."

MANAGER: "Did you notice anything that might indicate Mr. Smith's hobbies?"

SERVICE MAN: "Yes, he has two nice Irish setters, some golf clubs and some very spiffy fishing tackle."

## *Act II*

### (Scene 1)

Thursday afternoon—3:30 P. M.

[Mr. Smith arrives and is escorted to the manager's office.]

MANAGER: "Good afternoon, Mr. Smith. I am happy to see you."

CUSTOMER: "What did you find?"

MANAGER: "Just have a seat. I have some rather interesting things to show you and tell you."

CUSTOMER (rather stoically): "Yea. From the size of that bill it must be interesting."

MANAGER: "Mr. Smith, here is a chart which shows your consumption from 9:00 A.M. yesterday to 9:00 A.M. this morning. I note that you are an early riser."

CUSTOMER: "Yes, I have been getting up at 6:00 o'clock for years. I like to do a little work in the garden before breakfast."

MANAGER: "Now, Mr. Smith, this little red line on this chart is figuratively speaking the life line of your family for one day. It indicates here that the first water was used for a short while at about 6:05 A.M., and here it is indicated from about 6:30 until 7:15 breakfast was being prepared. I can tell by the rise of the red line. A straight line, Mr. Smith, indicates no consumption. A rise or fall indicates that water is being used, and the degree of inclination indicates the rate at which it was used. It is indicated there that your family had breakfast from 7:15 to 7:55, and a normal amount of water was used up to 11:00 A.M. Right here I would assume that the breakfast dishes were being washed, and the remainder of the consumption, which you will notice was periodic, was probably used during the normal house cleaning. The preparation of lunch was begun at 12:05. It is indicated that you had lunch from 1:10 to 1:45. Apparently the lunch dishes were washed immediately after 2:00 P.M., and no water was used by your family from 3:00 until 5:00 P. M. except at 4:15 there is an indication here that a commode was flushed. Now, Mr. Smith, there are two indications here that may be of interest to you. The first is that someone flushed a commode this morning at 2:15 A.M."

CUSTOMER: "I think you are wrong. Everybody in my house was in bed last night by 11:30, and I don't think anybody got up during the night. Let me use your 'phone a minute."

CUSTOMER (over telephone): "Mary, did you get up last night for anything? I am down at the water department office, and they are trying to tell me that someone flushed a commode at 2:15 this morning. (Pause) Oh yes, James—I had forgotten about him. Yes, alright, thank you—Goodby."

(Customer hangs up receiver.)

CUSTOMER: "My wife says that my son, James, went to a dance last night and came in about 2:00 o'clock this morning, so I guess it must have been he that flushed that commode."

MANAGER: "The most outstanding indication on this chart, Mr. Smith, and one that you will be most interested in is that you have a rather bad leak in your plumbing. You will notice the gradual rise and fall of this line over the entire 24 hours that this chart was on. Those abrupt changes show that water was being used by your family, but the very gradual rise and fall indicates the leak. Right here you will notice it very plainly from 11:30 last night until 6:00 this morning when you arose."

CUSTOMER: "I don't believe I have any such leak as that. If I did, I would have so much water around the place I would have to have a boat to get into the house. Why I couldn't use that much water if all my spigots were running wide open all of the time."

MANAGER: "Mr. Smith, while our man was out there he located this leak for you with a very sensitive instrument that we use for such purposes, known as a Geophone. He found the leak near your spigot in your garden. He noticed that someone had been dumping ashes at this point, and that was no doubt the cause of your leak. All ashes contain a certain amount of acid, and normal rains will wash this acid down into the ground, and the acid will very quickly eat up your pipe line. Now, Mr. Smith, if you will have this leak stopped, we shall be very glad to refund to you 50% of your excess consumption. In other words we will pay one-half of your loss if you will pay the other one-half, and we think that is a fair proposition. If you bought a gallon of milk and dropped it on the way home, your dairyman would expect you to pay for another gallon. We don't know of any other merchant in town that operates under such a liberal refund policy as we do; however, we believe that it pays large dividends, we believe that you were unaware of this waste, and we

are glad to share some of the expense with you. That would make your bill only $9.57."

CUSTOMER: "I am surprised to learn that I had such a leak; however, everything that you have shown me and have told me has stacked up so well that I am afraid that you are right."

MANAGER: "By the way, Mr. Smith, you live next door to Henry Green, Manager of the Telephone Company, don't you?"

CUSTOMER: "Yes, I do. I have known Henry for quite a long while. I hunt a little with Henry every fall."

MANAGER: "I have heard about your dogs—our meter service man admired them very much. He told me that you had two very beautiful Irish Setters."

CUSTOMER: "Yes, they are very good dogs. I bought them when they were puppies and trained them myself."

MANAGER: "Are you a golfer, Mr. Smith?"

CUSTOMER: "No, my son plays the golf for the family. I hunt and fish for my recreation."

MANAGER: "Does Henry fish with you too?"

CUSTOMER: "Yes, Henry is really a dyed-in-the-wool fisherman."

MANAGER: "What kind of fishing do you and Henry do?"

CUSTOMER: "Well, Henry and I visit most of the mountain streams for mountain trout. The sportier they are the better I like them. We also try to get down to the coast and do a little salt water fishing once or twice during the summer."

CUSTOMER (rising): "Well, I expect I had better go and have that leak attended to."

MANAGER: "Just a minute, Mr. Smith, there are one or two other things I would like to tell you while you are here. When you came in the first day, you spoke of not washing your automobile at home, of sending your laundry out, and of doing very little lawn sprinkling. It may surprise you to know that all three of those usages account for a very small portion of your water consumption. For instance, the average family uses only 1% of their water for car washing, only 4% for laundry, and about 3% for lawn sprinkling, which you see is only 8% of your total consumption.

CUSTOMER: "Well what are the larger percentages used for?"

MANAGER: "About 45% is used for flushing toilets, 30% for bathing and washing hands, and the remainder for drinking, cooking, household cleaning, and other miscellaneous uses. As a matter of fact, Mr. Smith, for a yard with a 50-foot front and the house setting back 50 feet, it requires 3000 gallons of water to be equivalent to 1 inch of rain. The average lawn sprinkler runs about 5 gallons per minute, or 300 gallons per hour, and at our rate you can sprinkle your lawn for an hour for only 9c. You pay $600.00 per ton for coffee, $100.00 per ton for sugar, $60.00 per ton for flour, $20.00 per ton for salt, and $7.00 to $15.00 per ton for coal. Mr. Smith, you pay from $3.00 to $5.00 for a truck load of dirt for your rose bushes—yet you pay only 7.2c per ton for water—next to the air that you breathe in importance. You might live as long as three months without food, but without water you could live only a few days. Yet your water costs you only 3.6c per thousand pounds. Mr. Smith, the old saying "cheap as dirt" is a misnomer. It should be "cheap as water."

CUSTOMER (rising again and extending his hand): "Well, Mr. Brown, I want to thank you for looking into this matter for me. Those facts that you have just given me are very interesting. I was a little upset when I first came to see you about this bill, and I am afraid that I was influenced to a certain extent by one of my neighbor's lamentations. However, I should not have been, because he is a habitual complainer. I hope you will pardon my rudeness Tuesday."

MANAGER: "Oh, don't worry about that, Mr. Smith, we are always happy to serve you in any way possible."

CUSTOMER: "Good by, Mr. Brown."

MANAGER: "Good by, Mr. Smith."

(Customer departs)

## *Act III*

(Next afternoon)

MANAGER (answering his telephone): "Hello, yes—Why hello, Mr. Smith! So you found your leak without any difficulty. Well I am glad. Did you say that your plumber had completed the job of repairing it? Well that is fine. There is really no hurry about that. In that case we will get it in the morning's mail. Do you want us to mail you a receipt? We will be glad to do so if you wish. That's right, your check is a sufficient receipt. No, I have no plans for Saturday afternoon. I do fish occasionally. Since you mentioned it I believe the fishing season does open Saturday—yes that's right, Saturday is the 16th. I would be delighted. At 1:00 P. M.? Why yes, that would be convenient. I would be glad to take my car. Well that's mighty nice of you. You will pick me up here at the office? That's mighty fine, Mr. Smith; I will be awfully happy to accept your invitation, and I will be ready promptly at 1:00 P. M. Saturday. Thank you. Good by."

(Curtain)

## *And So It Was—*

And, this was the beginning of a long friendship between Mr. Smith and Mr. Brown.

Conditions in our City are no different from conditions in your town or City. There are certain psychological conditions to bear in mind in settling any complaint. One must bear in mind that the consumer has planned his approach, his attack and his arguments—this for, maybe, two weeks. Therefore, if he is particularly unrelenting and uncompromising you cannot hope to break down his arguments and reach an amicable settlement with him in ten or fifteen minutes, nor even an hour. The slightest suggestion of such a weakness on his part is an insult to his intelligence and a challenge to his pride.

Ask him to leave the bill with you; to forget that he even received it and above all not to worry about it until he sees you again at some pre-arranged time. Assure him that you, and as many of your employees as are necessary, will devote any amount of time necessary to thoroughly investigate the conditions of the complaint, that not a single stone will be left unturned and that no expense will be spared in obtaining all the facts. Then let him go home and sleep over the matter and cool off. At least he will begin to wonder what is to happen.

It has been said that Noah Webster was once upon a time caught by his wife hugging their maid. Mrs. Webster said, "Why Noah, I am surprised." The ultra correct Noah said, "No, dear, you're *astonished*; I am *surprised*."

So, surprise your complaining customer with your genuine pleasant interest and sincerity and astonish him with real facts and logical reasoning. Try to kill him with kindness.

Treat him as if he were the only consumer in the world. Try to find some common meeting ground with him during the interview to lessen the tension. Ask him about his family, his children, his bird dogs, his fishing, his golf, his garden, his roses, his civic work—anything that will start him talking about himself or one of his hobbies. Let him know that you know something of him if possible. This is like adding sugar to a sour lemonade. It doesn't take much effort or time to do a lot of good when just a little preparation is made following the first interview.

Your approach may vary, your solution may be slightly different in each case, but with the same fundamentals you can make friends of ninety-nine percent of your consumers. At least this has been our experience, and the first success leads one on to realize a genuine pleasure in the accomplishment. It's something, I imagine, like converting sinners and saving souls.

# DURHAM'S NEW TANK LARGEST IN NORTH CAROLINA

By DONALD BECKER
DURHAM, N. C.

DURHAM, N. C., can now boast the largest elevated water tank in North Carolina.

This new unit of 1,500,000 gallons capacity has come up to all expectations in respect to performance, and has gone a long way toward equalizing water pressure in this industrial city of the South, where the demands of large factories have previously resulted in sudden drops in the pressure in the mains.

The tank is the latest addition to a water system that began as a private enterprise in 1887. The system was acquired by the city in 1916. From 1891 until his recent death (for 48 years) Capt. John C. Michie has been its Superintendent. Now the system is under Superintendent D. M. Williams, an employee of the Water Department for 16 years and Assistant Superintendent since 1930.

### *Part of Long Range Plan*

The erection of this tank constituted a part of a coordinated plan developed by our Consulting Engineer, William M. Piatt of Durham, about 15 years ago, when work was begun on an impounding dam north of the city, providing Durham with water storage for domestic supply and power generation amounting to nearly five billion gallons.

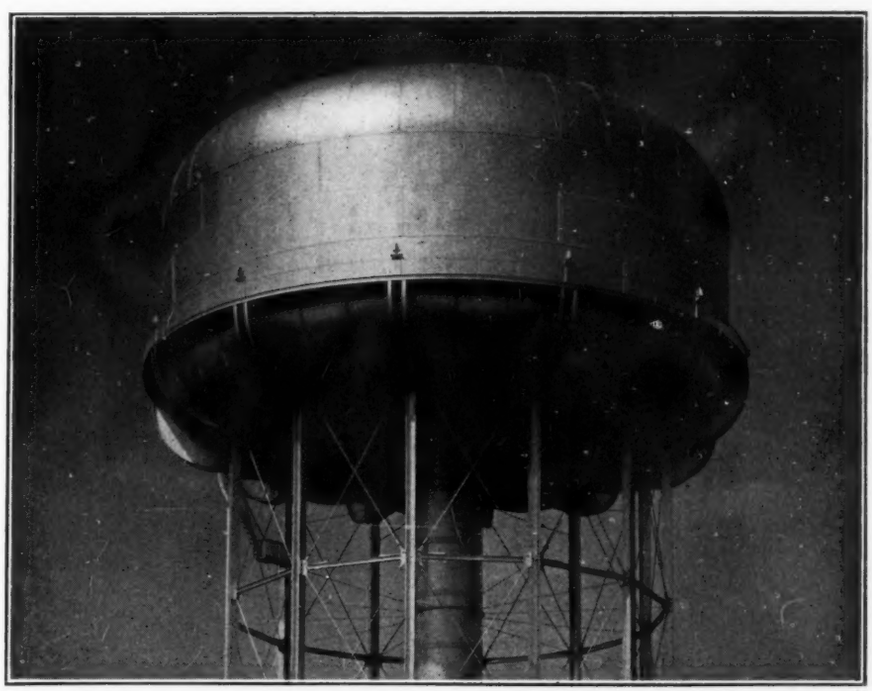
The system now consists of Lake Michie, on Flat River, 12 miles north of Durham; a filter plant at the northwest edge of the city, with a capacity of 9,500,000 gallons; an elevated reservoir for purified water, 1.5 miles west of the filter plant, holding 3,500,000 gallons; and the 1,500,000-gallon tank four miles east of the pumping station. The average daily consumption is 6,000,000 gallons.

A Bristol water level recording gauge, operating through a leased telephone cable line, is located at the city pumping station, where it registers continuously the level of the water in the new tank. The water levels in the tank and the elevated reservoir are equalized by Chapman automatic altitude valves in the lines leading to them. The bottom of the tank is 105 feet above its concrete foundation.

### *Costs and Results*

The tank, of radial-cone design, was built by the Chicago Bridge and Iron company and erected by the city with the assistance of the P.W.A. at a cost of $178,730.88—the net cost to the City being $100,014.13. Wm. Piatt, as the Consulting Engineer, saw his recommendation of 15 years ago materialize and the water service of Durham markedly bettered.

Cast iron pipe was furnished by the Glarmorgan Pipe and Foundry Company, Lynchburg, Va.; gate valves by the Ludlow Valve Company, Troy, N. Y.; altitude valves by the Chapman Valve Manufacturing Company, Indian Orchard, Mass.; hydrants by the Grinnell Company, Charlotte, N. C.; and water level recorder by the Bristol Company, Waterbury, Conn.



**Durham's Comforting 1,500,000 Gallons Sits on a Tower 105 Feet High.**

# FILTER DRESSING RIG

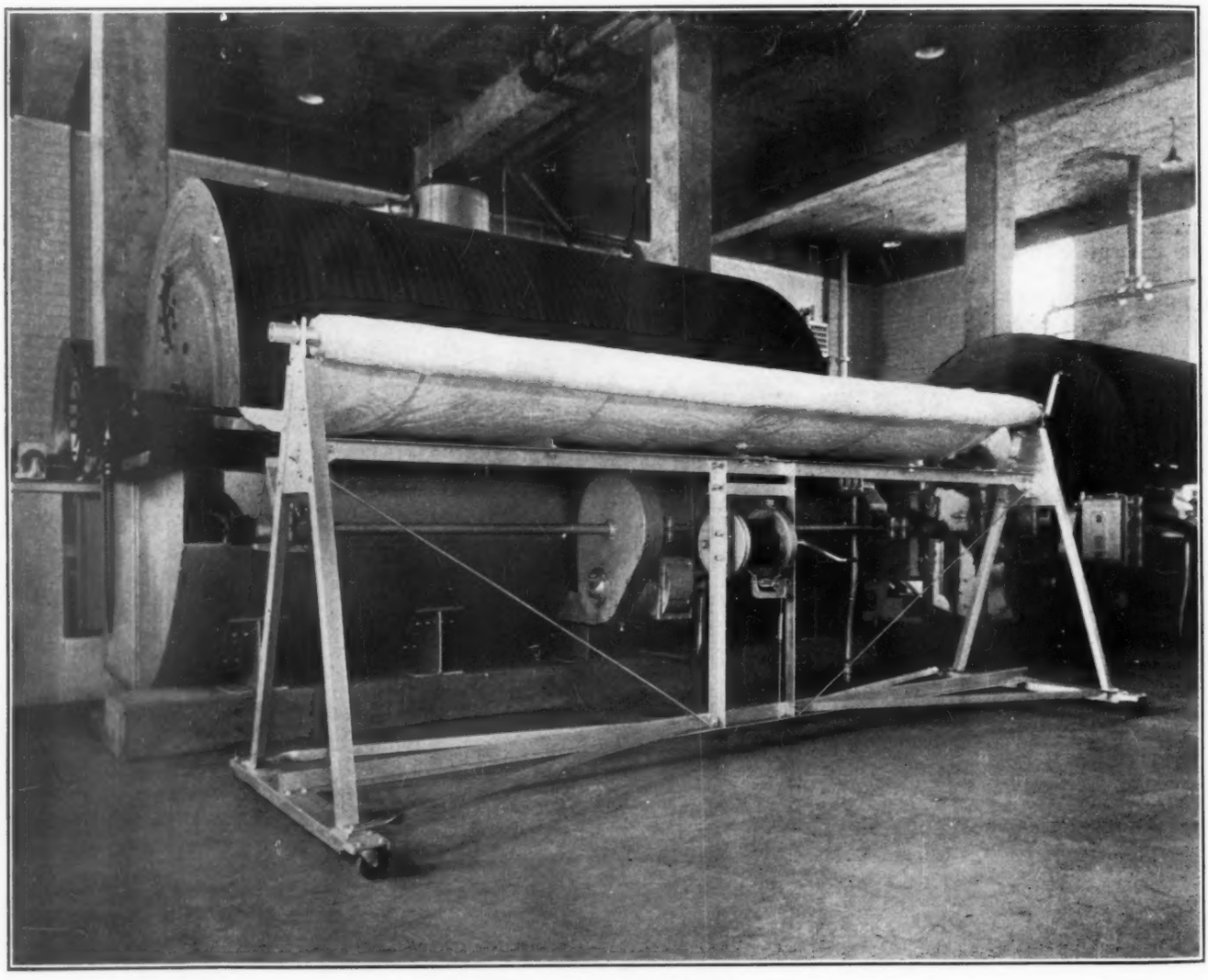
## *Cuts Re-clothing Time 60%; Saves Cloth, Wire and Religion*

By W. D. SHEETS
Shift Supervisor of Operation
SEWAGE TREATMENT WORKS
COLUMBUS, OHIO

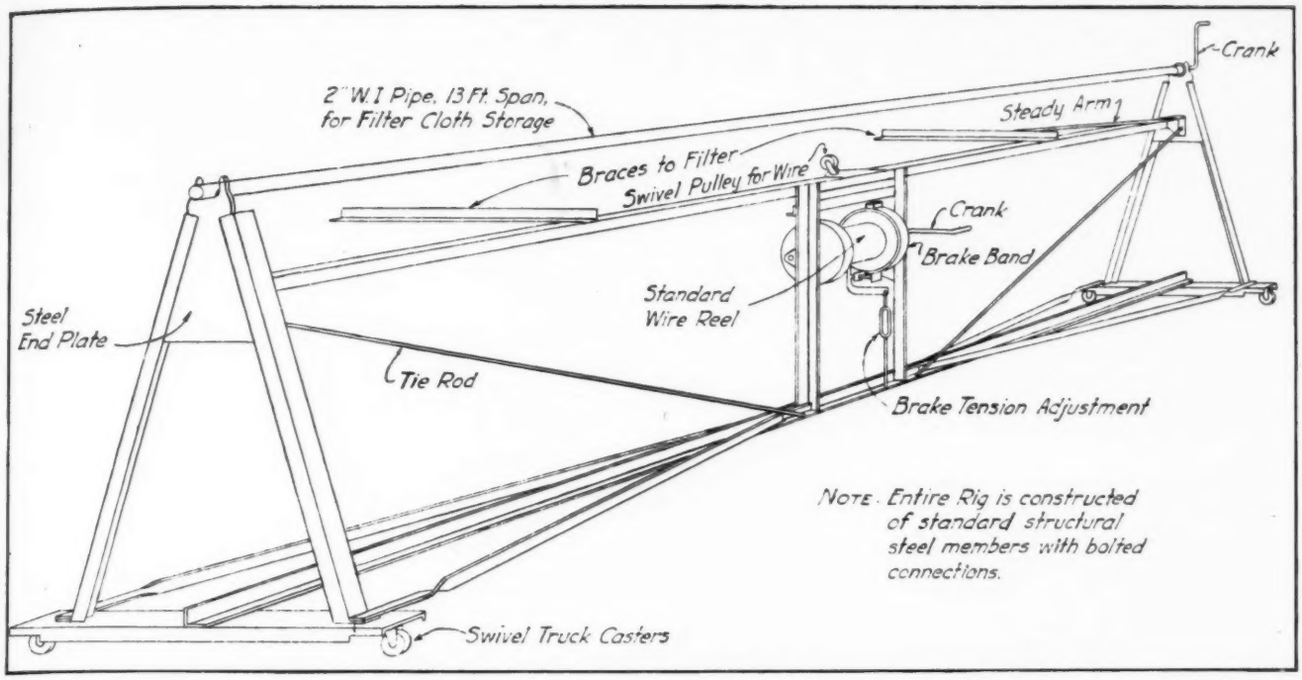
ONE of the greatest time-consuming operations in connection with sewage sludge dewatering by use of vacuum filters is that of dressing the filters. By "dressing" is meant the removal of the spirally wound holding wire and spent cloth for replacement with new cloth.

Filter cloth in this type of service is subjected to severe operating conditions, resulting in a relatively short life requiring frequent replacement. Conditioning sludge with ferric chloride and lime causes deposition of calcium salts and other insoluble compounds in the interstices of the cloth. Although such choked cloths may be rejuvenated by dry scrubbing or by giving a dilute hydrochloric acid bath in place, (3% acid or less), the fibers eventually break down from the acid and acid insoluble compounds prevent further treatment. Even ferric chloride when used alone has a similar effect, the deposits consisting of iron compounds which are unaffected by the acid bath.

The Author



**Columbus Filter Dressing Rig**
*Set in position for re-clothing a filter. For structural details see line drawing.*




**Sketch Showing Simplicity of Construction of the Columbus Rig**

*Lightness of weight and swivel casters makes for easy handling. Note wire saving reel at center.*

The total filter installation at Columbus consists of four 8 ft. by 12 ft. filters having an area of 300 sq. ft. each. Individual cloths are approximately 13 ft. by 25 ft., a size that is bulky and cumbersome.

When operations were started at Columbus, a wiring rig of 4x4's, such as described in the manufacturers' instructions, was constructed and used with individual cloths for some time. This was extremely heavy and very hard to anchor properly, requiring constant attention to keep it at the correct angle with respect to the filter drum.

### *An Improved Rig Developed*

A study of the situation was made and the following improvements were believed possible by the design of new apparatus:

(1) Storage and handling of a continuous roll of cloth to eliminate from 1 to 2 feet of waste at each change.

(2) To facilitate the removal of the old wire and to assist in the reapplication of *the same* wire.

(3) Maintain the proper tension in the wire when rewinding.

(4) Satisfactorily braced while in use without requiring a release of the anchorage when correcting for direction of wire pull.

(5) Ease of transportation from one filter to another.

A sketch of the proposed apparatus was made and turned over to our machine shop. Requiring approximately 30 man hours to build it, the mechanism was turned out in record time at an exceptionally low cost.

The accompanying photograph shows the wiring rig in position and illustrates the manner in which the cloth is applied to the filter. A single cloth was used in this photograph to show the comparative capacity of the rig when a full bolt is in place.

Not shown in the photograph, or drawing, is a hand-operated lever put to use when rewinding the old wire. This lever guides the wire into position on the reel (center of rig) and prevents pyramiding. Such pyramiding results in subsequent collapse and loss of tension when rewiring. This lever is mounted on the angle iron member seen just above the wire reel. It moves back and forth in a horizontal plane when in use.

### *Results Attained*

With respect to the improvements listed above the corresponding results were as follows:

(1) Cloth is now purchased in sections having a width of 12-ft. 8-in. and 152-ft. in length. This length is sufficient for six coverings.

(2) Since the wire used is monel-metal, and subject to deterioration only through wear, its careful removal from the drum and its re-use represents a saving of approximately 1200 feet of wire per re-covering. The only loss is a short section, from the filter drum to the reel on the rig, which is necessary to hold the tension on the entire winding until it has been anchored at the drum.

(3) Any tension desired can be attained through the adjustable brake drum on the reel.

(4) Very rigid bracing resulted, and direction of wire pull is automatically corrected by a swivel pulley directly above the wire reel.

(5) The apparatus can be disengaged, moved to another filter and attached ready for operation in 5 minutes.

This rig is extremely adaptable and has cut the time of dressing from approximately 16 man hours to 6½ man hours per filter. It has enabled the filter operators to change a cloth while attending to their regular operating routine. Several coats of aluminum paint have made it perfectly at home in its present surroundings and it has proved exceptionally satisfactory in all respects.

## Water Supply Temperatures (The highest high and the lowest high)

On looking through a table of maximum water temperatures in prominent cities, Lowell, Mass., records the lowest maximum in the United States. The temperature of their city water never goes higher than 50 deg. F.

On the other hand, Austin, Texas, records the highest, the maximum temperature reaching 96 deg. F.

# CENTRAL STATES ASSOCIATION HOLDS LARGEST MEETING

## Sees World's Largest Sewage Plant in Operation

THE Central States Sewage Works Association, holding its 12th Annual Convention in Chicago, October 12th and 13th, registered a record total of 240 of the approximate 275 or more in attendance.

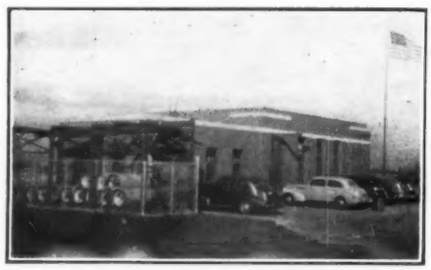
Featured on the technical program was a group of papers on sludge handling and disposal methods at the plants of Chicago, Minneapolis-St. Paul and Buffalo. And those attending the annual banquet heard Langdon Pearse, Chief Sanitary Engineer, present an illustrated review of highlights of the "Thirty Years of Progress in Sewage Treatment by The Sanitary District of Chicago," now involving an investment of $160,000,000 in treatment works and $60,000,000 in sewers and canals. Mr. Pearse pointed out that about $20,000,000 more would be required to complete the program to make a total investment of almost $250,000,000 in sewerage system of America's second city. Of particular interest was the disclosure that Chicago is now filling a contract for delivery of 38,000 tons of dried sludge for use as fertilizer base. The product having a computed value of $2.00 per ton as fuel, the fertilizer contract at $12.50 per ton yields a net return of $6.12 per ton—thereby, indicating the wisdom of installing the flash-drying system which allows marketing or burning of the product as economics dictate.

Incidentally, the 187 members and guests attending the annual banquet were treated to some especially fine musical renditions by Margaret Wood, Soprano, and Jeuska Slebos, Cellist of the Illinois Symphony Orchestra, with Wanda Paul at the piano, an accompanist of parts.

### *Awards and Honors*

To C. N. Sawyer and M. Starr Nichols of Madison, Wis., went the prize for the most valuable paper presented by a member during the past year. This annual prize is a cash award consisting of interest from a $500 bond held for the purpose.

On Dr. F. W. Mohlman was conferred a "Life Membership" in appreciation of his long services to and guidance of the Association.



**Chlorinating Station**
*Chicago's Southwest Plant*

In the Gadget Contest the successful "Gadgeteers" were:

G. C. Martin, Supt. of Sewerage, Green Bay, Wisc., who received the $5.00 cash award and the Mohlman Plaque. His entry was a "Hydrogen Sulphide Detector," the subject of an article appearing elsewhere in this same issue.

**The Retiring President**
*G. J. Schroepfer*
*Chief Engr.*
*Minneapolis-St. Paul Sanitary Distr.*

**The Incoming President**
*B. A. Poole*
*Chief Engr.*
*Indiana State Dep't. Health*

To W. E. Ross and D. Backmeyer, Sup't. and Chemist at Richmond, Ind., went the second prize for their "B.O.D. Dilution Bottle." And, to P. W. Richards of Indianapolis, went honorable mention for his "Motor Switch."

### *Officers 1939-40*

The following officers were elected:

President—B. A. Poole, Indianapolis.

1st Vice-Pres.—C. C. Larson, Springfield, Ill.

2nd Vice-Pres.—G. C. Martin, Green Bay, Wis.

3rd Vice-Pres.—K. L. Mick, Minneapolis.

Sec.-Treas.—W. H. Wisely, Springfield, Ill.

Continued as representatives on the Federation Board of Control was W. W. DeBerard of Chicago and J. L. Ferebee of Milwaukee.

### *Report of the Secretary*

In his report as Secretary and Treasurer, W. H. Wisely presented another accounting of an excellent stewardship and a noteworthy strengthening of the Association comprising a membership from the states of Illinois, Indiana, Wisconsin and Minnesota.

With a membership of 508 as of October 12th, a net gain of 127 members had been recorded for the year. Members from the four states are as follows:

| | |
|---|---|
| Illinois | 250 |
| Indiana | 101 |
| Wisconsin | 73 |
| Minnesota | 50 |

Especial attention was drawn to the gain of members from Indiana during the year, the number a year ago having been roughly one half the 101 now recorded. For such credit was given Paul J. Kleiser of Indianapolis.

The healthy financial condition of the Association was revealed in the $538 cash and $500 bond owned by it. Further, expenditures $277.59 less than receipts during the year reflected the member increase and management of finances.

Bids for the 1940 Convention were received from Ft. Wayne, Gary and Indianapolis, the choice to be made by the Executive Committee.

The convention closed with an afternoon devoted to inspection of Chicago's new 400 M.G.D. Southwest plant, which because of its shape and funnels silhouetted against the sky (see picture) has been aptly dubbed "The Queen Mary of the Prairie."

*Geo. C. Martin (2nd Vice Pres.), Sup't. of Sewerage, Green Bay, Wisc. C. C. Larson (1st Vice Pres.), Chief Chemist, Springfield San. Distr. Paul J. Kleiser, Asst. Engr., Indiana State Dep't. of Health. (Doubled Indiana's Membership.)*

## *Technical Sessions*

(G. J. Schroepfer, Presiding)

The first paper on the program was appropriately:

**"A Review of the Sewage Treatment Program of the Sanitary District of Chicago"** by WM. H. TRINKAUS, Chief Engineer, The Sanitary District of Chicago.

In his paper, presented by L. M. Johnson, Ass't. Engr., Mr. Trinkaus disclosed that since the beginning of Chicago's sewage treatment program (1914) $162,675,000 had been invested in sewers and treatment works—the latter now comprising 4 major and 5 minor plants. The largest of these are:

| *Plant* | *Design Capacity** |
|---|---|
| Calumet | 136 M.G.D. |
| North Side | 250 " |
| West Side | 305 " † |
| Southwest | 400 " ‡ |

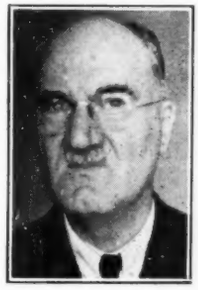
* All plants designed to take storm flows 50% in excess of normal flow.

† Undergoing enlargement to 472 M.G.D. capacity.

‡ World's largest treatment works; because of industrial wastes handles a load equivalent to almost 2,500,000 population.

Mr. Trinkaus in touching on the outstanding and novel features of the treatment program stressed sludge handling and its disposal, involving pumpage of all activated sludge from the North Side across the city to the Southwest plant where it is thickened and dewatered on vacuum filters, along with the Southwest sludge, dried in the flash-drying system and marketed as fertilizer or, at will, burned to supplement pulverized coal in the steam generating station of the Southwest plant. (As reported later in the meeting, the satisfactory present prices and demand for fertilizer has resulted in practically complete sale of the product with little so far having gone into steam generation.) For condenser-water in the power plant chlorinated effluent is employed, the chlorine being used to prevent insulating biological growths forming on the tube walls. The chlorinating station, considered one of the most important units of the plant appears in the header picture.

Another interesting fact disclosed was the rate of expenditures for betterments during the last five years in order to take advantage of P.W.A. grants and meet the date on which the U. S. Supreme Court had demanded that water taken from the lake for dilution be cut to 1500 cfs. over and above the takings for Chicago's water supply. In 1932 work had practically ceased when a P.W.A. grant of $16,000,000 made it possible to recommence. This, with subsequent grants had reached a total of $60,000,000 in grants during the last five-year period—or at the astounding rate of $1,000,000 every month to spur on sewerage construction.



**Honored Hosts**

*Langdon Pearse C.E., Chief Sanitary Engineer* **(Principal Dinner Speaker)**

*F. W. Mohlman Ph.D., Chief Chemist* **(Made First Life Member)**

**"The Flash Drying System of Sludge Disposal"** by WILLIAM DUNDAS, Mechanical Engineer, The Sanitary District of Chicago.

Mr. Dundas reviewed the large scale experimental work of the Chicago Sanitary District (20 tons/day of dry solids) which culminated in the perfection of the present vacuum filtration and flash-drying scheme of dewatering crude, activated, digested or mixed sludges for marketing as fertilizer base, or use as fuel in conjunction with pulverized coal in power production. The basis for the selection of the two-stage system of drying and incineration was the completeness of odor control and greater economic flexibility in operating on the basis of comparative values of the dried sludge for fertilizer as against its fuel value.

The first installation of 5 vacuum filters and 3 flash driers and furnaces, with a daily capacity of 40 tons/day of dry solids from a sludge cake of 80% moisture, went in at the Calumet plant to serve as a proving ground in the design and operation of the Southwest installation. It proved best to reduce the 80% moisture content of sludge to the cage-mill type flash driers to 40% by mixing in dry material through a recirculating system. The screw type conveyor system failing, such had been replaced by a satisfactory vacuum tube pneumatic system. To prevent ash fusion (furnace slagging) oil was substituted for powdered coal in the Calumet installation, which had operated continuously since July, 1938.

*Secy.-Treas., W. H. Wisely, Illinois State Dep't. of Health. (Will never be satisfied until his membership beats that of the boastful N. Y. Association.) Edw. J. Beatty, Asst. Engr., Wisconsin State Dep't. of Health. (Conducted a "Clinic" for small operators; big ones came too.)*

The Southwest works employs pulverized coal to allow complete diversion of dried sludge for sale as fertilizer to the most profitable degree—such being 100% at present. The installation with a production capacity of 480 tons of dry solids daily comprises 24 vacuum filters (11.5 diam. and 16' long) with capacity of 20 tons each, feeding a cake of 20% solids to 4 drying units (cage mills), the latter having an evaporating capacity of 160,000 lbs. of water per hour to produce a product of 6% moisture. When burning sludge, 4 boilers are fired with pulverized coal and dry sludge, mixed in the ratio of 10,500 lbs. of sludge and 8,350 lbs. of coal per hour to each boiler, to produce 70,000 lbs. of steam per hour per unit. The thermal efficiency tests had revealed an average of 62% and minimum of 42%.

To produce 831 tons of dry solids requires 57.6 tons of ferric chloride figured as absolute $FeCl_3$. An interesting and important provision is the shut down arrangement, in which the shut down of a unit results in the automatic shut down of the preceding unit in the straight line flow from wet sludge storage to chemical conditioning tanks, to filters, cake and powder mixers, driers, and finally the fuel jets. The rate of burning is likewise automatically controlled to prevent combustion reaching to the air preheaters and also to preclude ash fusion and slagging.

An interesting and little known disclosure was the fact that dehydration in the flash drying units is accomplished for the most part by recirculating super-heated vapors, thus increasing their de-hydrating capacity and limiting air input, heat waste, and oxidation in the high temperature zones; likewise for the purpose of avoiding the corrosive dew-point, reached when operating at lower temperatures.

## *"Operating Problems at the Southwest Plant"*

(A Symposium directed by A. H. Goodman, Plant Superintendent)

*C. T. MICKEL,* Supt. of Treatment, Southwest Plant, told of the exciting phases of putting the "World's Largest Treatment Works" into operation, August 1, 1939. Coarse screenings had thus far been disposed of on a dump and primary tank, skimmings were being bypassed to the plant outfall. However, plans called for construction of special incinerators to burn both. To provide uniform solids distribution in the primary tanks 800 ft. of channels are aerated to maintain uniform solids suspension. In the activated plant the total of 1 cu. ft. of air per gallon was being distributed as follows; in the aeration units 0.7 cu. ft.; in the channels 0.13 cu. ft.; in the return sludge channels 0.2 cu. ft. The diffusion system design made possible the application of tapered-aeration, but exact distribution control of the air had proved difficult. The final (radial flow) tanks designed for 1200 gpd./sq. ft. of surface area had actually operated at 1400 gpd./sq. ft. with fairly satisfactory results. Sludge level indicators consisted of air-lift pipes terminating at various elevations and discharging to common observation boxes in the operating gallery. The primary and secondary sludges of the Southwest plant, plus the mixed sludge pumped from the Northside plant, (the latter arriving in a septic state) were run together continuously and air-mixed to produce a product of fairly uniform consistency for the thickening operation preparatory to conditioning for the filters.

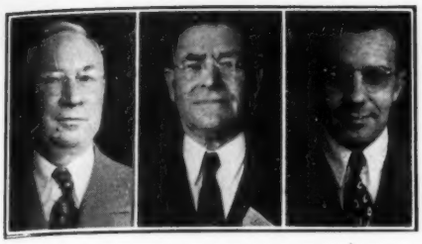
*G. G. POINDEXTER,* Chief Chemist, Southwest Plant, emphasizing the normal weakness of the sewage (B.O.D. 172 to 39; depended solids 299 to 58), revealed that only 1500 to 2000 solids were being maintained in the mixed liquor—the volume of returned sludge varying between 13 and 22%. In the air control the mixed liquor was being sampled and tested for dissolved oxygen at 4 hr. intervals by gallery operators, the modified Winkler method for D.O. determinations being employed. In eliminating nitrite interference (2.6 ppm) use of the Sodium Azide modification had proved effective and made the method a success. For a time an aerating period of 2.6 hrs. seemed adequate. However, cutting in another sewer made it necessary to boost the period to better than 3.5 hrs.

Concerning sludge handling, a two stage scheme of concentration is employed ahead of conditioning with ferric chloride to an optimum pH of 3.5 to 4.5.

For the condensers 43 mgd. of chlorinated plant effluent had been required. The high nitrites in the effluent (5.4 ppm. at times) had been responsible for a chlorine demand in excess even of that of the settled sewage. Therefore air input was reduced to lower nitrites to only 0.48 ppm. in the effluent. Even so, between 1 and 2 ppm. D. O. could be maintained in the effluent. The chlorine requirement to produce 0.35 to 0.5 ppm. residual had required 5400 lbs. of chlorine daily to the 43 mgd. used.

*ROY HAGEMAN,* Mechanical Engineer, Southwest Plant, pointed out that industrial plants could be put into operation by stages, whereas a sewage treatment plant had to be put into operation all at once and everything had to click. Such a plant as the Southwest plant really required a new type of operation, involving minutely detailed operating instructions and ample charting in colors. The importance of effective lubrication had necessitated detailed lubricating charts with corresponding numbered brass tags at each lubricating point on various equipment units. The plant staff had been organized into 6 Divisions, with a

**12th Annual Banquet Central States Sewage Works Association.**



*Paul Hansen, Consulting Engr., Chicago; R. E. Rowley, Chairman, Sanitary Commission of Gary, Indiana. (Retired Chief Engr. U. S. Steel Co. drafted for civic-service.) C. W. Klassen, Chief Engr., Illinois State Dep't. of Health. (His report on pollution abatement on the Illinois River a noteworthy revelation of quiet accomplishment.)*

Mechanical Engineer in charge of each. These were—(1) Steam Generation; (2) Pump and Turbine; (3) Incineration and Ash Handling; (4) Vacuum Filtration; (5) Metering; (6) Maintenance.

Concerning record keeping, the extensive filing system involved 30 main divisions, each with sub-divisions. The importance of daily condition records was stressed by Mr. Hageman.

Some design features, which had proved their worth, included ample elevation of vacuum filters; chlorination of condenser water (in this instance effluent or settled sewage); bar screens that can be lifted and rotated out of the channels for replacement of wearing shoes, or repairs; the use of super-heated vapor in the flash drying operation; elimination of troublesome shear-pins and substitution of motor kick-out with alarm signal; all speed reducers of totally enclosed oil immersed type; automatic air velocity control in furnaces to preclude ash slagging and combustion in preheaters; thermostat control of dampers (valves) regulating sludge feed (40% moisture) to flash driers.

## *Sludge Disposal at Minneapolis and Buffalo*

**"Sludge Disposal at Minneapolis"**
by GEO. J. SCHROEPFER, Superintendent, Minneapolis-St. Paul Sanitary District.

Mr. Schroepfer briefly described the sewage treatment works of Minneapolis and St. Paul, (in operation since June 1, 1938) which provides plain sedimentation, sludge dewatering and incineration, with auxiliary chemical precipitation applied only when river conditions warrant the higher degree of treatment. Sludge handling and its disposal, dealt with in considerable detail, consists of its transfer by pumps to two thickening tanks of 24 to 48 hour retention. The thickened product is lifted by bucket elevators to chemical conditioning tanks, from which it flows by gravity to the battery of 6 (11.5 x 14 ft.) vacuum filters. The filter cake travels by belt conveyors to the three multi-hearth incinerators (8 hearths, 60 ton dry solids capacity per day each) from which the ash is sluiced to pumps, having a capacity of 720 tons dry ash per day and discharging to ash ponds. Chemicals are handled by pneumatic conveying systems, lime and liquid ferric chloride being employed in sludge conditioning.

Sludge from the primary clarifiers has contained on the average 7.84% solids (pH 6.0); thickened sludge 7.84% (pH 5.9 after 24 to 48 hr. storage); the filter cake 35.4%, (max. = 39.1% and min. = 34.2% as averages by months). Monthly average of volatiles in the cake has been 56% (max. = 62.3%).

Chemical requirements in conditioning have been markedly reduced through improved operating facilities, experimentation and study. Early dosages of 10.3 to 11.7% lime (in terms of CaO) and roughly 3% $FeCl_3$ have in recent months been reduced to 3.25 to 5.97% (CaO) and 1.76 to 2.44% $FeCl_3$ (2.08% avg. during past 6 months), productive of filter yields of 4.47 to 6.21 lbs. solids/sq. ft./hr., the average for the year being 5.31 pounds as against design yield of 2.5 to 3.0 pounds.

Average plant production in tons of dry material handled per day had involved 92.6 tons of solids to the filters, producing 273.0 tons daily of wet filter cake (64.6% water), resulting in 43 tons daily of ash containing less than 2% combustibles. In early stages of the multi-hearth incinerator operation it was soon found that there was excess heat (6,000,000 BTU. per hr. per incinerator) to be dissipated. Such was successfully accomplished by increasing cooling air intake and reducing cooling water through the central shafts of the rabbling arms.

Concerning incinerator performance and operating costs, the guarantee of 60 tons of solids per unit was readily exceeded, producing ash of 1.6% volatile content. Fuel oil, required only for bringing idle units up to temperature, amounted to only 2.4 gals. per ton of dry solids for a filter cake averaging 64% moisture. As to overall operating costs, $0.455 per dry ton compared with the guarantee of $0.707 per ton. In brief, this differential provides an annual

*K. V. Hill, Greeley and Hansen, Engrs., Chicago. W. T. McClenahan, Engr., Chicago Sanitary Distr. (The District's authority on paints and protective coatings. Incidentally is producing a series of articles for this magazine.) C. R. Velzy, Sup't. Sewage Treatment Works, Buffalo, N. Y. (Learned something new about sludge pumping and sludge force-mains.)*

saving of $10,237 over expected operating costs. Power requirements had amounted to 15.5 KWH per dry ton, when operating the units to incinerate continuously at the rate of 59 dry tons daily during the nine-month period.

Mr. Schropfer's paper revealed installation costs as follows:

| | | |
|---|---|---|
| Complete Plant ..... | = | $3,750,000 |
| 6 Vacuum Filters & Appurtenances ..... | = | $402,000 |
| 3 Incinerators & Appurtenances ..... | = | $340,282 |
| Chemical Feeding & Handling Equipment ..... | = | $ 25,511 |

Operating and maintenance costs during the last 6 months had averaged per dry ton—

| | | |
|---|---|---|
| For Dewatering | = | $2.35 |
| For Incineration | = | $0.95 |
| | | $3.30* |

* Maintenance included was 36c per ton.

It was pointed out that of the overall costs, those chargeable to investment and depreciation amounted to but 22% of the total. Interesting was the disclosure that of the operating costs alone (this plant providing primary treatment and complete sludge disposal) 50% was chargeable to handling and destruction of the sludge.

In his concluding remarks, Mr. Schroepfer stressed the value of flexibility in design of the sludge handling end of the plant, in which ample duplication and standby units had made continuous operation possible and productive, thereby, of maximum overall economies. In this direction the sludge and thickening tanks had served as storage reservoirs, more valuable as such than any actual benefits resulting from mere concentration. Uniformity of product and continuity of supply had

proved of paramount value in attaining performance and operating costs so pleasingly below specifications.

Mr. Schroepfer's paper, which contains much of value to designing engineers and operators, discloses certain operating difficulties encountered and remedies provided. Amongst these are a stripping device provided for cutting the sludge sheet into ribbons for more satisfactory belt conveying; means of prevention of belt curl at the edges; improved spray wash of filter cloths by altering angle of jet impingement; improved air-mix in conditioning units; improved seam stitching of filter-cloths; sand-blasting as the most economical method of removing the blinding carbonate deposits from the metal screens beneath the cloth. (All of these are to be covered in a paper, to appear as one of the series of articles currently running in this magazine on the topic "Sludge Filtration."—Ed.)

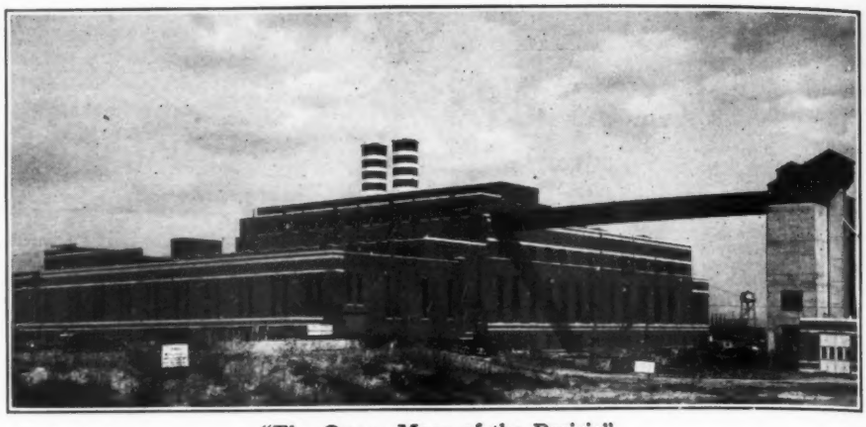
**"Filtration and Incineration at Buffalo"** by C. R. VELZY, Superintendent and HAROLD EPSTEIN, General Manager, The Buffalo (N. Y.) Sewer Authority.

Mr. Velzy's paper briefly described the new treatment works of Buffalo (in operation since July 1st, 1938) which provides disinfection (by prechlorination), sedimentation, partial sludge digestion, vacuum filtration and incineration. In the crude sludge to digesters solids vary between 3.5 and 9%. After 20 day digestion it becomes of rather uniform quality and solids content averaging 12%. From it is produced a filter cake averaging 38% solids, of which only 38 to 39% is very fine free grit. The marked grit content had created a serious abrasion problem in incinerator operation, necessitating withdrawal of one unit from operation for monthly inspection and repairs.

In burning grit from the grit removal units a problem had been its transportation by pneumatic methods, sticks and heavy objects having caused chokages. In sludge burning, synchronization of units had been a problem. Now, a method of regulating filter cake delivery based on furnace temperature changes had been devised, rather than dependence on the continuous weight-belt from the filters, which was the original method of control of filter cake charging.

Concerning the 20 day digesters—gas production has been at the rate of 1 cu. ft./capita and is being utilized as auxiliary fuel in pre-heating the incinerators and maintaining odor free operation. Top sludge (reaching depths of 6 to 8 ft.) was being taken off by pumps along with the bottom sludge to the filters. The filters had yielded 5 lbs./dry solids /per hr. per sq. ft. on the average, at times handling 13.4 lbs. per sq. ft. (69% moisture cake).

In sludge handling, one problem had been the sludge ring forming in an 100 ft. run of a 10 in. line, resulting in pumping pressures of 50 to 60 lbs., whereas only 30 lbs. had been the anticipated maximum specified in selecting sludge pumps. Examination indicated the sludge ring (assumedly grease accumulations) had closed all but a 3 in. area, indicative of the probable preference for smaller force lines in order to maintain scour velocities. Also, the resulting higher pumping pressures than anticipated, thus indicating the need for more sturdy equipment than customarily provided for sludge pumping. The 10 in. line had been cleaned with steam and hot water, resulting in some joint leakage. This experience had indicated the desirability of smaller sludge lines, and provisions for steaming out wall depositions, with flexible type couplings to serve as expansion joints.



**"The Queen Mary of the Prairie"**

*So dubbed, is Chicago's 400 M.G.D. Southwest Sewage Treatment Works and sludge-burning power plant. Newest unit in Chicago's 220 million dollar sewage disposal system, needing another 20 million to complete.*

*H. G. Rogers, Prin. Asst. Eng'r, Minn. State Dep't. of Health. Joe W. Nadin, Sup't. of Sewerage, Paris, Ill. (Sailed the sea so long that he just can't stay away from "salty water".) Louis R. Howson, Consulting Eng'r, Chicago. (Loud in his praise of Gary's non-political Sanitary Board, composed of three engineers.)*

Mr. Velzy pointed out that studies revealed pre-chlorination of Buffalo sewage to be the most economical and overall practical chlorinating procedure. A probable average chlorine requirement of 7 ppm. had been indicated, but plant operation had revealed only 5 ppm. to be the actual requirement to satisfy the varying chlorine demand. To meet such requirements, and preclude chlorine waste, several dosage changes were being made during each 24 hour period. Emphasizing the value of pleasing architectural concrete work and landscaping of grounds, Mr. Velzy's lantern slides of the Buffalo plant (in color) served as adequate evidence of what a few extra dollars applied in "finish" has accomplished at Buffalo.

## *Treating Packinghouse Wastes*

**"Packinghouse Wastes Treatment at Austin, Minn."** by PAUL HANSEN and K. V. HILL, Greeley and Hansen Engineers, Chicago.

This paper, presented by Mr. Hansen, described the conversion of the existing domestic sprinkling filter plant of Austin, Minn., into a combination plant, designed to handle domestic sewage from 18,000 and packing waste cut by chemical pretreatment to reduce a B.O.D. value of 2000 to 600 before discharge at the packing plant to the city sewerage system. The resulting population equivalent loading will be 80,000 persons in the 4 m.g.d. flow to be treated in the revamped plant, involving high-rate filtration followed by slow rate filtration, and further supplemented by chemical treatment and for chlorination at lowest stream stages.

Pre-treatment, which has been provided by the Hormel Company con-

*(1) From Sioux Falls, S. Dakota, came Commissioner Bert Yeager and City Engineer R. E. Bragstad; (2) Wm. F. Tempest, Sec'y. of AWWA's Committee on Sewer Rentals and Engineer of the Portland Cement Assoc., with Louis Dallavia, Sup't. of Sewer Maintenance, Duluth, Minn.; (3) Yeoman's V. P. and G. M., D. W. Burgoon, with "Water Works and Sewerage's" Larry Lingnor; (4) Ray E. Plummer, Engr. of Design, and C. E. Williams, City Engineer of South Bend, Ind.; (5) Of the Twin-Cities—St. Paul's Milton Rosen, Commissioner of Public Works, and Allen Wagner, Exec. Secy., Minneapolis-St. Paul Sanitary District; (5) Also with the same District is B. M. Storey, Plant Operator, and S. J. Larsen, Mechanical Engineer.*

tinuously since October 1930 (and to be continued), involves screening and superchlorination of the *fresh* concentrated wastes for the purpose of precipitating proteins and fats, which are settled out to produce an effluent averaging 600 B.O.D. value and 200 ppm. suspended solids. This treatment alone proving insufficient to meet late summer stream conditions, has necessitated construction of the new dual purpose plant by the City and the packers, as a joint enterprise, to produce an effluent of 30 ppm. B.O.D. whenever stream conditions require such degree of treatment. Otherwise the plant will be operated on a more economical basis, to secure a 55% reduction in B.O.D. when conditions permit.

In designing the plant the engineers, considering maximum flexibility and minimum operating expense, have provided bar screens and screenings grinder; an equalizing tank, through which the whole of the sewage flow must pass, with its rate of discharge to treatment governed by a Venturi rate controller; 30 minute mechanical flocculation; clarification, followed by high-rate filters (15 to 24 mgd.); intermediate settling; second stage (slow rate) filters; final settling and chlorination. Arrangements are provided for chemical precipitation in the pre-flocculation when desired; also for pre and post chlorination. Two stage sludge digestion (25 lb. solids/month /cu. ft.) is provided for the mixed sludges.

The settled sewage (predicted to average 480 B.O.D.), will be diluted by continuous recirculation of secondary filter effluent. From the high-rate (first stage) filters the effluent is expected to have a B.O.D. of 140, or, with pre-flocculation provided, less. The second stage (slow) filters will reduce the 140 B.O.D. to 30 parts, during the 30 to 50 days per year when their operation and extra cost of recirculating effluent is justified. So the plant may produce anything from 55% to 80% purification biologically, and intermediate or higher degrees when chemicals and final chlorination is applied, possibly 30 days per year.

The circular filters (68 ft. diameter) are covered with Hewitt Concrete Domes. The sewage is to be recirculated 3 times through the 6 ft. deep primary units to produce rates of 15 to 24 mgd./acre continuous application. The secondary filters (8 ft. deep) will operate at a nominal 4.45 mgd./acre. Intermediate and final settling tanks provide 1.35 hrs. detention each at rates of 1040 gal. /24 hr. per sq. ft. of surface area. The plant will cost $357,716 when completed.

*Scott Linsley, Chief Filter and Incinerator Operator, St. Paul-Minneapolis Treatment Works; Wm. L. Ashdown, Sup't. Sewage Works, East Chicago; Frank W. Lovett, Engr., Link Belt Co., Chicago*

**"The Treatment Works of Gary, Ind."** by L. R. Howson, Alvord, Burdick and Howson Engrs., Chicago.

Mr. Howson, set forth the reasons for having chosen the activated sludge process for Gary, Indiana, and described the new plant now under construction to provide treatment for 40 mgd. average and 60 mgd. maximum. The plant will have 5 Chicago Comminutors, with motors located 15 ft. above the screenings cutters. Pumps will be driven by gas-engines with automatic speed regulators, operated to lift 15 to 25 mgd. and keep apace of sewage flow. The primary clarifiers, of square design in batteries of four units, were chosen on basis of comparative costs. The aeration units provide 5 hr. aeration through porous fixed tubes (40 permeability) located 24 in. above the floor. Compared with diffuser plates, there was a saving of $15,000, and 2 ft. less air head is required. Digesters provide two stage digestion (4 cu. ft./capita), with gas storage (140,000 cu. ft.) provided under the floating covers of the second stage units. The primary tanks have fixed covers and are equipped with Turbo Mixers. Air blowers consist of 3 centrifugal and 2 Connersville type units, directly driven from gas engines mounted on a spring base. Digested sludge will be air dried on the natural sand beds of the area. No underdrain system being required, their cost was only 20 cents per sq. ft. A Caterpillar loader and truck loading platform is provided for use by sludge takers. The cost of the liberally designed plant will be $1,715,500.

In the design considerable thought was given to architectural treatment and every known precaution taken to minimize noise and vibration, by effective foundation dampeners for engines and blowers and the use of acoustical tile in all ceilings. Concerning garbage disposal, Mr. Howson stated that the liberal design of the treatment plant would permit of garbage grinding and disposal to sewers, and burning of rubbish, at a cost of $156,000. However, at the treatment plant 3 additional digesters would be required at a cost of $175,000. It had been estimated that the added values to be recovered as digester gas should run to between $13,000 and $19,000 per year.

Mr. Howson praised the Gary Sanitary Commission, a strictly non-political board comprised of 3 engineers, with whom it had been a genuine pleasure to work. The Chairman, who attended the meeting, is the retired Chief Engineer of the U. S. Steel Corp., and the City Engineer of 20 years standing, is another member of the Board.

*B. A. POOLE,* Chief Engr., Indiana State Dept. of Health, indicated further progress in pollution abatement in the lake area in his remarks that orders had also been issued against East Chicago, Whiting and Hammond — a plant at Hammond being already under construc-

tion. And a plant for Crown Point should be under construction in the next month or so. (So with plants under construction at Ft. Wayne, Gary, South Bend and Hammond, and to be soon built at East Chicago, Whiting and Crown Point, Indiana is making its fair share of progress in sewage treatment.—Ed.)

## *Accomplishments in the Illinois River Valley*

A highly interesting paper was that presented by *C. W. KLASSEN*, Chief Engineer, Illinois Department of Health, which constituted a presentation of facts distinctly new and somewhat surprising to many concerning what has been quietly accomplished in abatement of pollution of the Illinois River and its feeder streams.

Mr. Klassen, stating that Chicago's program having opened the way, the Sanitary Water Board of Illinois had now been successful in getting 110 municipalities, representing 93% of the population on the Illinois River and tributaries, to provide sewage treatment. Further, and more of a surprise, practically all industrial plants in the basin are now providing some form of waste treatment. He cited the three basic principles on which the State Board based its actions and conclusions.

(1) Most wastes are different.

(2) Lack of known or proven methods of correction and treatment indicates only a lack of industrial research such as is applied in development and production.

(3) Allowable pollution loads must be based on adequate studies of the particular stream involved.

Procedures followed in securing the Illinois development of noteworthy magnitude were those of:

(1) Acquainting the industry with its part in the pollution survey and waste treatment studies. (Such had involved an exchange of information held valuable to the industrialists, and had required absolute confidence.)

(2) Ample time given industrialists to employ consultants and make studies. (The result: by January, 1939, a population load of 2.2 million people will have been brought down to 300,000—a reduction of 85% in total pollution load. Nothing better than such accomplishments could show that it *can* be done—and done by industry.)

(1) *Harley C. Bocke, Sup't. of Sewage Works, Racine, Wisc.*; (2) *Ed. Shelton, The Tennessee Corpn., Atlanta, Ga.*; (3) *M. I. Weil, Pres. Chicago Pump Co., Chicago*; (4) *Byron Hartmann, Link Belt Co., Chicago*; (5) *Milton Speigel, Eng'r., Chicago Pump Co.*; (6) *Miles Lamb, Sup't. Sewage Treatment, Belvidere, Ill.*

An interesting comment was that only in a few instances had Illinois River industries failed to profit as the outcome of abatement. In one instance successful marketing of a new cattle food (from wastes) had caused a Wastes Disposal Division to be re-named the Food Products Division. In another instance savings in "brewers grain" had saved a distiller $1,000,000 in a drought year. Distillers had now come to look for savings through recovery to pay the whole cost of all raw materials.

(So, it was with an understandable degree of satisfaction that Mr. Klassen could point to such accomplishments in the Illinois Valley as the 80% reduction in the 3.7 million population equivalent pollution load; and, without recourse to the process of law in a single instance. In truth a laudable accomplishment, and one that constitutes pollution abatement *news*.—Ed.)

**"Activated Sludge Oxidation"** by C. N. SAWYER, Ass't. Professor, University of Wisconsin, Madison.

Mr. Sawyer's paper constituted a report on the extended laboratory studies of the behavior of activated sludges. This paper reported on "The Influence of Nutrition in Determination of Sludge Characteristics," the 1938 paper in the series having won for him and co-author, Dr. W. Starr Nichols, the Association's annual award for the most valuable paper of the year presented by a member.

The studies involved sludges from four plants, exhibiting various operating characteristics, which were correlated with sludge behavior in laboratory sludge feedings. A nonnitrifying sludge, from a plant treating domestic and packinghouse sewage mixed, after 24 days of laboratory feeding with domestic sewage approached the behavior of a good nitrifying sludge. Many curves were exhibited to reveal characteristic rates of oxygen utilization, wherein nitrifying sludges exhibited a very high initial rate as against a sluggish rate for non-nitrifying sludge.

In comparing results, it was apparent that the ratio of 5 day B.O.D. and ammonia nitrogen in the sewage has a marked influence on nitrification as follows:—

### *Results*

*B.O.D./NH₃*

8.3 Produced the best nitrifying sludge
12.6 Appeared to be the breaking point
16.3 Appeared to represent the upper limit

Checking with plant conditions, that plant treating a sewage with a B.O.D. value 21 times the Ammonia nitrogen value gave the poorest nitrification, and always has. However, in terms of work accomplished the non-nitrifying sludges appear to be giving the more economical plant operation.

## *Operators' Breakfast*

(Geo. C. Martin—Presiding)

It was Friday the 13th, and thereby doubly fitting that the Operators' Round Table be opened with a discussion of "Safety" by Mr. Donnell of The Mine Safety Appliances Company, who briefly described the numerous safety instruments and appliances supplied by his company for the detection of toxic or explosive gases, gas masks for various purposes, safety belts and alarm systems for plants.

*G. C. MARTIN* (Sup't. Green Bay, Wisc.) stated that to avoid hazard all gas equipment, including compressors had been isolated in a separate room. Around the plant only explosion proof motors and non sparking switches had been installed.

*W. D. HATFIELD* (Sup't. Decatur, Ill.) recommended the overhauling and cleaning of pilot-light cut off on gas boilers at 6 month intervals. Sulphide in the gas seems to gum up this mechanism to create a hazard. He stressed the point that a false sense of security bred of confidence in equipment was to his mind a hazard of real consequence.

(1) *Dr. Bartow (Univ. of Iowa) and, beyond, appear the hands of an ex-student, Dr. Hatfield (Decatur, Ill.) expressing approval of a musical rendition following the banquet;* (2) *A wind blasted group at the Southwest Treatment Works;* (3) *While Mrs. Ruchhoft of Cincinnati is oblivious, Ralph Busher (Fort Wayne's Sewerage Engineer) doesn't seem much interested in "Hark, Hark the Lark!"*

**"Paints for Sewage Works"** were discussed by W. T. McClanahan, Ass't. Engr., Chicago Sanitary District, who presented a number of basic considerations. He stated that residual mill scale or moisture on the metal surface had proved the most serious interferences with effective adherence of paints, regardless of how good the product. Weathering action (rusting), according to Chicago experiences, could not be depended upon to remove mill scale sufficiently unless an unduly long period of exposure was allowed. In commenting on the Sanitary District's *"Manual on Paints,"* Mr. McClanahan pointed out that priming coats (shop coats) were specified differently for under water and above water service. In the District 40 paints were in actual use out of the 220 on the approved list. One varnish base in particular (D-37) was being used in as many paints as possible. He pointed out that it was a fairly costly product, but had proved more economical in the long run. Mr. McClanahan closed by stressing the fact that paint making was more of an art than a service; that formulas meant little or nothing, while the vehicle meant everything. [Mr. McClanahan, who is looked to as the District's authority on paints, is preparing a series of articles on "Paints and Protective Coatings" to appear in this magazine.—Ed.]

### "Screens and Comminutors"

Discussion of this topic was participated in by J. M. Holderby (Sup't. Menasha, Wisc.), C. O. Baetz (Sup't. Appleton, Wisc.), Thornton Walbridge (Sup't. Waukegan, Ill.). Mr. Holderby felt continuous feeding of the Chain Belt "Triturator" preferable to the customary batch feeding. Mr. Baetz was strong in his praise of his Link-Belt hammer-mill type of shredder. Mr. Walbridge had found maintenance cost on Chicago Comminutors high at first, but now lower. Four to five "Stellite" teeth were being replaced monthly at $1.50 each. However, the old teeth have a trade-in value, and also can be resharpened.

[One may judge from this sketchy account that the Operators' Breakfast Round Table was not up to that of a year ago. Time allotted proved inadequate, resulting in a vote to extend the time for such informal discussions in future meetengs.—Ed.]

## *Small Plant Operators' Clinic*

(E. J. Beatty, Leader)

Simultaneously with one of the main sessions a "Small Plant Operators' Clinic" was arranged and conducted by E. J. Beatty, Ass't. Engr., Wisconsin State Dept. of Health.

[For the following account covering this "Clinic" attended by about 50 men, we are indebted to R. S. Nelle, Ass't. Engr., Illinois State Dep't. of Health.—Ed.]

### *Plant Maintenance*

*G. C. MARTIN,* Sup't. Green Bay, Wisc., was requested to open a discussion on plant maintenance. Difficulties encountered with corrosion of metal, and deterioration of paint on housed-in units as the result of moisture and gases, were outlined. It appeared that although 200 to 300 paints, from over fifty manufacturers, had been tested none was entirely satisfactory under the conditions existing at Green Bay. Even aluminum paint was found to crumble if not applied correctly. Hot-dipped galvanizing, stainless steel, and aluminum were found to be fairly durable. Copper screening lasted only about six months. Truss members, window sash, and louvres were particularly in need of protective covering. Failures due to improper lubrication of machinery had been eliminated only after adoption of a greasing schedule and placing of definite responsibility for care of units. Experiments on various packings and sleeves led to the adoption of a uniformly hardened steel sleeve for all pumps.

*C. A. WAHLSTROM,* Sup't., LaCrosse, Wisc., described the means by which local assistance had been obtained to furnish materials for plant beautification. Wood benches, a flag pole, bird houses, vases, a drinking fountain, lily pond, flag stone walk, and several varieties of trees were among the items donated for use in plant beautification. As a result of the beautification the plant grounds had become an attraction to local civic clubs which, incidentally, also inspect the treatment works.

### *High-Rate Filters*

Chairman Beatty opened the discussion on high- and low-rate filters with especial reference to the desirability of effluent recirculation. *MATH FISHER,* West Bend, Wisc., disagreed with the effectiveness of recirculation. He found that filter flies were killed by dosages of chlorine and they did not recur until recirculation was resumed. He suggested that perhaps larvae were returned to the filter in the effluent. *T. J. BURRIN,* Sup't. Kokomo, Ind., reported that flushing filter walls by streams of sewage from holes in ends of rotary distributor had helped prevent fly breeding.

*J. W. NADIN,* Sup't., Paris, Ill., reported on operation of a high-rate filter with special reference to forced draft during periods of high air temperatures and low sewage flows. *H. G. ROGERS,* Minneapolis, Minn., supplemented the high-rate discussion with his observations that continuous high-rate dosage prevented formation of flies.

*J. E. HUPP,* City Engr., LaPorte, Ind., stated that a filter clogged by wool fiber was relieved by heavy chlorination.

### *Activated Sludge*

In a discussion of activated sludge plant operation, it was generally agreed that the proper amount of suspended solids in mixed liquor depended upon so many factors that it constituted a problem for each plant to work out. Don Bloodgood, Indianapolis; W. E. Ross, Richmond, Ind.; J. C. Mackin, and C. N. Sawyer, Madison, Wisc., gave interesting viewpoints as to the mechanism of activated sludge in various concentrations.

A discussion of over-aeration indicated that while ordinarily over-aeration is a rarity, it is possible to reduce the activity of the sludge by overaeration and produce a granular

material having low index, rapid settleability, causing "feathers" or scum in the secondary settling tank.

According to *W. E. ROSS,* Sup't., bulking troubles have been reduced and an economy in air consumption effected by use of the Indianapolis Biometer at Richmond, Ind.

### *The Supernatant Problem*

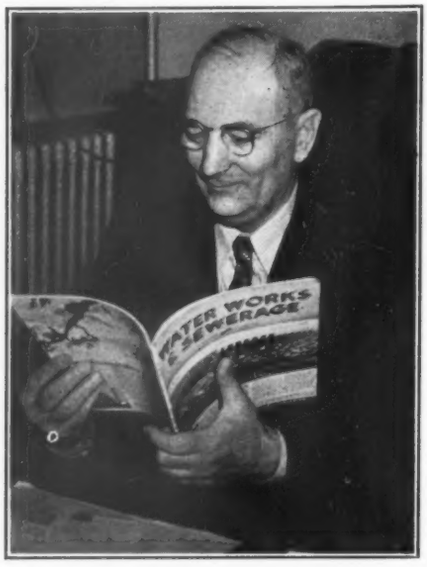
A discussion of supernatant return brought out the fact that this feature is particularly important in plants employing the activated sludge process. *H. H. JONES,* Sup't., Michigan City, found that no bulking has occurred since aerating the supernatant for 20 hours before return to raw sewage. Aeration of supernatant with activated sludge added was not successful.

*W. E. ROSS* (Richmond), and *R. H. CORR* (Woodstock, Ill.) reported markedly increased gassification and turbid supernatant following additions of waste activated sludge direct from the final tanks to the digester.

*DR. F. W. MOHLMAN* and *MISS GLADYS SWOPE* (Chemist, Waukegan, Ill.) reported that the slight reduction in suspended solids and B.O.D. obtained by short preaeration of sewage, without addition of chemicals, was not significant. On the other hand, Bloodgood reported that 75-80% and 85% B.O.D. reduction and suspended solids removal, respectively, resulted from plain aeration of sewage for 4½ to 5 hours at Indianapolis.

An attempt to treat sulfite pulp mill waste at Green Bay, Wis., proved an interesting experience according to *G. C. MARTIN.* It produced slime in the clarifiers, and the digester gas had as high as 300 grains of hydrogen sulfide per 100 cu. ft. Since 150 gr. per 100 cu. ft. was considered as high as permissible for use in gas engines, the sulfite waste was cut off.

## D. M. Williams Becomes Superintendent at Durham




City Manager H. A. Yancey has announced the appointment of D. M. Williams to succeed the late Col. J. C. Michie, as Superintendent of Water and Sewerage at Durham, N. C., which position Col. Michie held for 48 years.

For the past 9 years Mr. Williams has held the position of Assistant Superintendent, and has been connected with Durham water supply developments since 1923. For some time, during Col. Michie's illness, he has been acting head of the Department.

Mr. Williams, a native "Tar-Heel," was graduated by the University of N. Carolina in 1910 with a degree in electrical engineering. In 1913 he entered the consulting engineering field and came to Durham in 1923 to become associated with W. M. Piatt during the construction of major water supply betterments for Durham. In the World war he served with the 105th Engineers, entering as a buck private and emerging as first-lieutenant.

Misses Hugo Walker and H. P. Redding have been made Assistant Superintendents at Durham.

## "What Attendance at Annual Meeting of the A.W.W.A. Has Meant to Me"

**By .....(?)**

Do you want to do a job for yourself and for the possible benefit of others? If so, read further.

The Industrial Chemical Sales Division, West Virginia Pulp and Paper Company, are the sponsors of a contest to test the worth of water works conventions to those who go to them.

This company is offering worth while prizes for the three best papers submitted on the above subject, as follows:

First prize—$50.00.
Second prize—$25.00.
Third prize—$10.00.

Anyone connected with the water works field is eligible to compete in the contest, other than employees of the Industrial Chemical Sales Division. Papers submitted should not exceed 250 words, and all such submissions remain the property of the Industrial Chemical Sales Division. Three prominent editors in the water works field have agreed to serve as judges in the contest, and the decision of the judges will be final. The best papers submitted will be published.

The closing date has been set for December 31, 1939, any submissions postmarked prior to January 1, 1940, being acceptable. We regret that this announcement was too late in reaching us for our November issue—but there is still time if you do not delay. Mail your entry at the earliest possible moment to Contest Editor, Industrial Chemical Sales Division, 230 Park Avenue, New York, N. Y.

## "Bob" Regester Opens Engineering Office

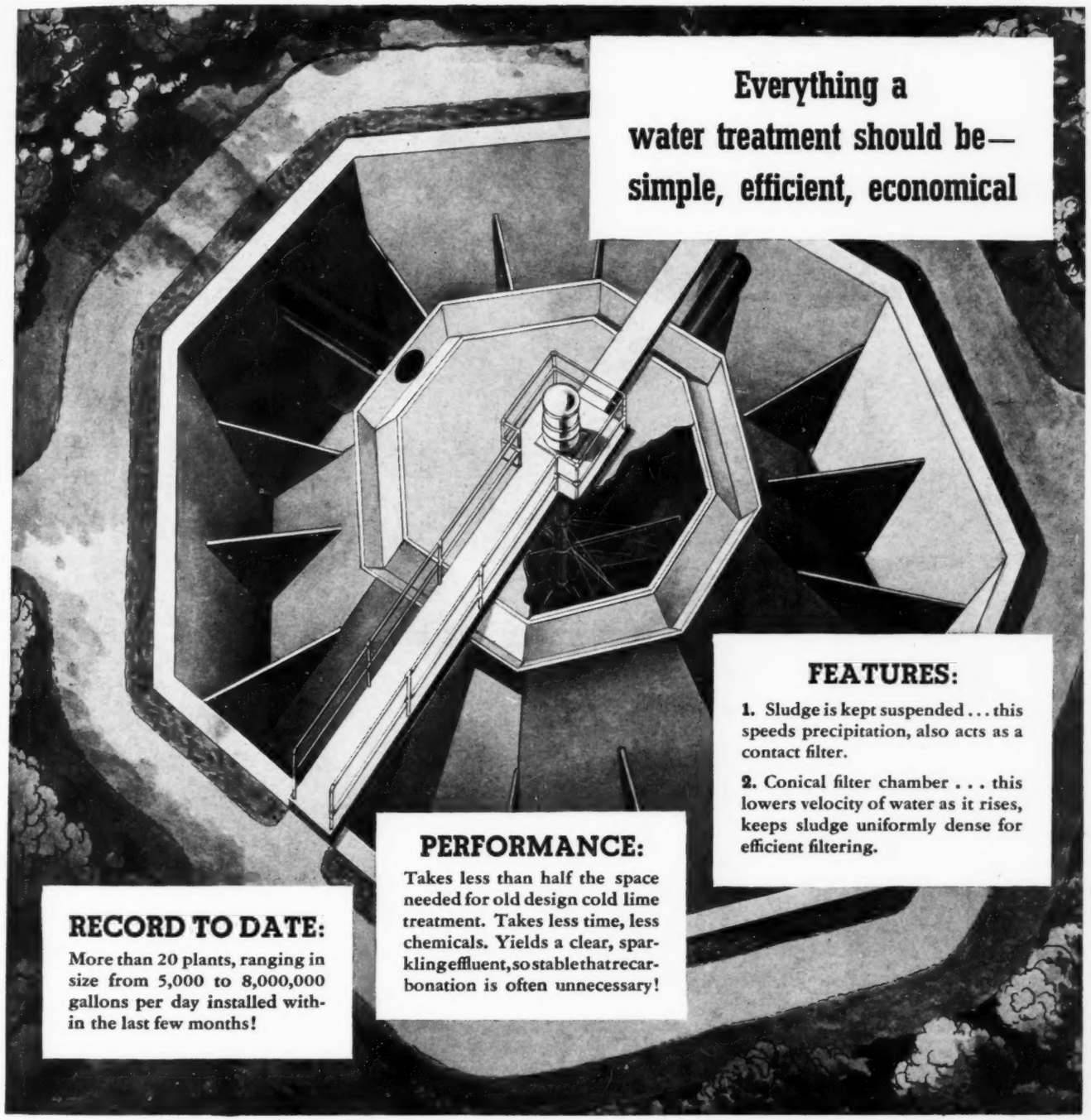
Robert T. Regester has recently announced the opening of his own office for consulting practice in Sanitary Engineering.

Mr. Regester for several years has been associated with Whitman, Requardt and Smith, Engineers, of Baltimore, Md. During design and construction of the new Treatment Works of Columbus, Ohio, he served as Designing Engineer, thereafter returning to Whitman, Requardt and Smith to serve in connection with the design of the Baltimore Treatment Works.

Mr. Regester's office is in the Baltimore Life Building, Baltimore, Md.

# PERMUTIT SPAULDING PRECIPITATOR

## for Iron-Free Soft Water



**Everything a water treatment should be— simple, efficient, economical**

### FEATURES:

1. Sludge is kept suspended . . . this speeds precipitation, also acts as a contact filter.

2. Conical filter chamber . . . this lowers velocity of water as it rises, keeps sludge uniformly dense for efficient filtering.

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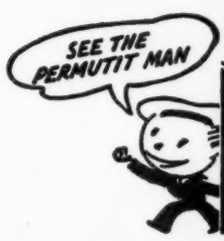
Diagrams, layouts, actual installations, full information. No obligation . . . address The Permutit Company, Dept. G1, 330 West 42nd St., New York.

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**WATER CONDITIONING** *Headquarters*

# Traditional

Music - Art - Customs - Faith

All are based upon tradition, which manifests itself in all its glory at this time of the year, as the culmination of inspirational acceptance to all refinements in thought, mind and deed.

In this spirit we extend to you our best wishes for Christmas and the New Year.

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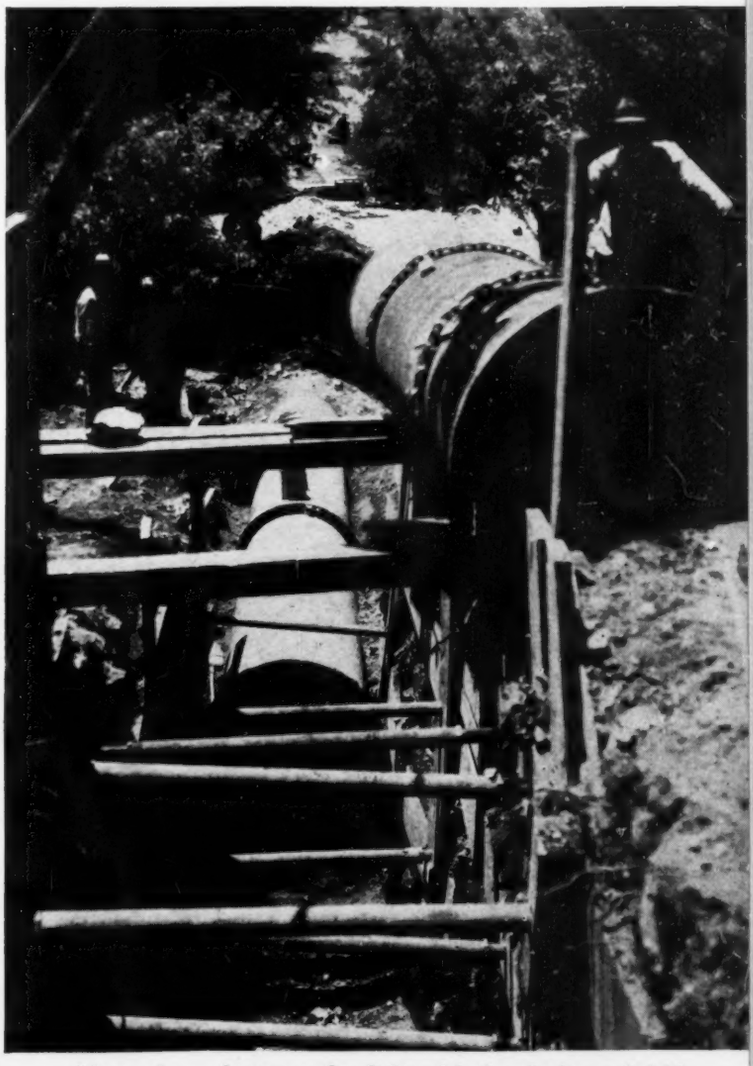
# THEY RELAID IT—WOULDN'T YOU?

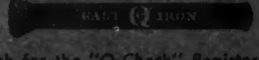
Highway improvements necessitated relocating a 36-inch, 46-year-old cast iron water main at Fort Worth, Texas. This pipe is shown above after being removed from the old trench.

At left is a close-up, unretouched photograph of a section of the relocated main shown here. Note fine condition of pipe interior.



Above is a photograph of the old pipe being relaid in a new location after 46 years of continuous service.

Salvage value is one of the three major economies of cast iron pipe. Long life and low maintenance cost complete the thrift story of this standard material for underground mains, know as Public Tax Saver No. 1.

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# THE DETERMINATION OF HYDROGEN SULPHIDE

By GEORGE MARTIN
Superintendent of Sewerage
GREEN BAY, WISC.

IN MAKING routine determinations of hydrogen sulphide in sewage, sewage gas, and polluted waters it was found that the procedure as described in Standard Methods was not satisfactory, due to the fact that polluted waters and sewage have an iodine demand. Therefore, a modified or special method of procedure was adopted. This special method is based upon the known fact that filter paper treated with a lead acetate solution will darken when placed in contact with hydrogen sulphide. It was found that by making a set of standards, with which any sample might be compared, consistent and fairly accurate results could be obtained.

### *The Apparatus*

The apparatus necessary for making these determinations consists of a standard 500 ml. filtering flask, on the inside of which is placed an air diffuser made of a perforated aluminum tube connected to the flask's side tube by means of a rubber hose. On the outside of the side tube there is attached the rubber air intake hose. The lead acetate paper is held in place on the top of the suction flask between a rubber ring "A", which is a standard Gooch crucible holder for an ordinary two-inch funnel, and a standard Gooch crucible holder "B", as is ordinarily used with a filter flask. "A" and "B" are held together by a utility clamp fastened to a ring stand. The rubber hose which is attached to the glass tubing of "B" is connected to a suction device.

### *The Procedure*

In making a determination with this apparatus the sample to be tested is delivered into the flask directly from a pipette through the aeration tube. Air is then drawn through the liquid for two minutes and by so doing the hydrogen sulphide passes on up through the lead acetate paper, discoloring it. The amount of hydrogen sulphide is determined by comparing the colored lead acetate paper with the standards and converting the results into the desired units.

In order to operate this apparatus satisfactorily it is necessary that there be at least 100 ml. of liquid in the flask. Thus, if the sample being tested is high in hydrogen sulphide, it becomes necessary to dilute it with hydrogen sulphide free water. If it is desired to have the final results in p.p.m., this figure is arrived at by multiplying the color comparison in mg. by 1000 (mg. per liter = p.p.m.) and dividing by the ml. of sample used.

Example: Sample = 10 ml.
Volume of water added to flask ahead of the sample = 90 ml.
Color comparison = 0.05

$$\text{p.p.m.} = \frac{0.05 \times 1000}{10} = 5 \text{ p.p.m.}$$

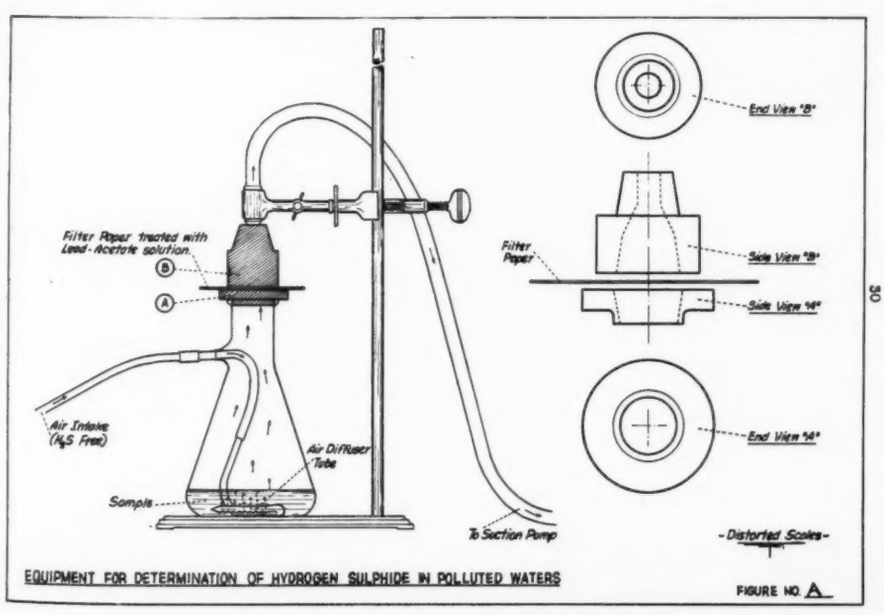
Gas may be tested for hydrogen sulphide content by passing a known volume through the above described apparatus.

### *Test Papers and Standards*

The lead acetate paper is prepared by soaking filter paper in a 10% solution of lead acetate and drying in an oven until approximately 10% to 15% of the moisture remains in the paper. The paper must then be kept in an air-tight container.

Standards are made from a solution of hydrogen sulphide prepared by generating hydrogen sulphide in distilled water from iron sulphide by the addition of dilute sulfuric acid, the solution being standardized by iodine titration.

[Note: The apparatus herein described won for the author first prize in the Gadget Contest conducted at the recent Convention of the Central States Sewage Works Association. —Ed.]




EQUIPMENT FOR DETERMINATION OF HYDROGEN SULPHIDE IN POLLUTED WATERS

FIGURE NO. A

## Duke Has College of Engineering Prof. Hall Made Dean

The Division of Engineering of Duke University which has heretofore been administered as part of Trinity College, has now been reorganized into the College of Engineering of Duke University.

W. H. Hall, Professor of Civil Engineering, has been made Dean of Engineering. The full time teaching staff consists of four men in the Civil, four in the Electrical, and five in the Mechanical Engineering Departments. The enrollment, which has been set at a maximum of 225, is now 216.

# VENTURI METERS FOR SEWAGE AND SLUDGE

## Their Proper Design and Installation

By CHARLES G. RICHARDSON, C.E.
Builders Iron Foundry
PROVIDENCE, R. I.

ONE of the great contributions to hydraulic engineering was Herschel's invention, a half century ago, of the Venturi Meter. Today it is both common and sound engineering to specify Venturis for the main flow lines of municipal plants and systems. A small community may need but one meter; on the other end of the scale are great cities like New York with their vast network of supply and distribution water mains, or the enormous sewage treatment plants of the Sanitary District of Chicago, requiring hundreds of meters of this type.

### *Accuracies and Diversity of Adaptations Increased*

As water and sewage treatment has progressed, close accuracy of measurement of main line flows has increased in importance, correspondingly. It has been accompanied by a growing demand for special instruments, some with automatic control of level, flow, or chemical dosages; others to furnish records of particular value in the allocation of costs of treatment, or in the supervision of plant processes. For instance, in the recently completed Minneapolis-St. Paul Sanitary District, which collects and treats the sewage from both cities, the flow into the system from Minneapolis is measured through three sets of large meters in widely separated locations. The readings are all brought by wire to a common point, there summarized, and thereafter the totals are sent over a telephone circuit to the plant in St. Paul, ten miles distant. Here two 9-foot diameter Venturis measure the entire incoming flow from both cities.

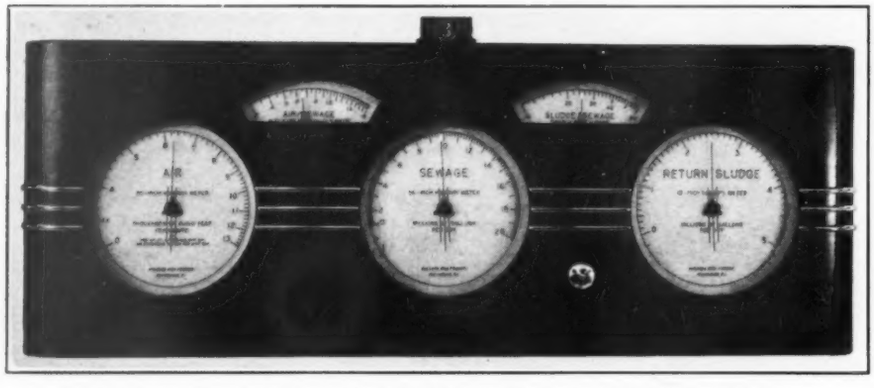
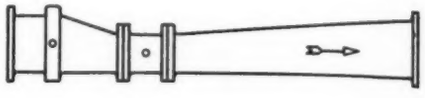



**Fig. 1—Special Gauge for Baltimore Sewage Treatment Plant**

The very nature of a properly made Venturi Tube with its wall guidance of flow throughout its length, the maintenance of orifice (throat) diameter, multiple piezometers, the general sturdiness of construction, and other individual features, makes it as permanent as the pipe line in which it is placed. The high velocities of flow tend to produce self-cleaning, and there is also the very important combination of relatively large differential pressures, for actuating recording instruments, with small overall loss of head through friction.

For the Back River plant (now in construction) at Baltimore, numerous special instruments will be



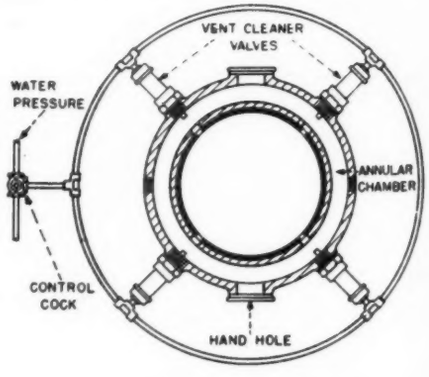
FLAT INVERT TUBE

**Fig. 2—The Flat Invert Tube**

found. One type is illustrated by Figure 1: there are five dials, the three largest showing respectively the rate of flow through Venturi Tubes, (1)—of air to aeration tanks, (2)—sewage to aeration tanks, (3)—return sludge from settling tanks. The two small dials indicate the ratio of air to sewage ("cubic feet per gallon"), and the ratio of sludge to sewage in "per cent." In addition, there is an automatic control of the latter ratio at any desired value, such being set by the operator to best meet operating conditions.

### *Concerning the Basic Features of Design*

It has been truly said, "anyone can make a Venturi Tube." Indeed, one might take a length of steel pipe, strike it with a sledge in the middle, and produce a crude form of Ven-




HYDRAULIC VENT CLEANER ASSEMBLY (CROSS SECTION)

**Fig. 3—Hydraulic Vent Cleaning Assembly**
*(A recent development.)*

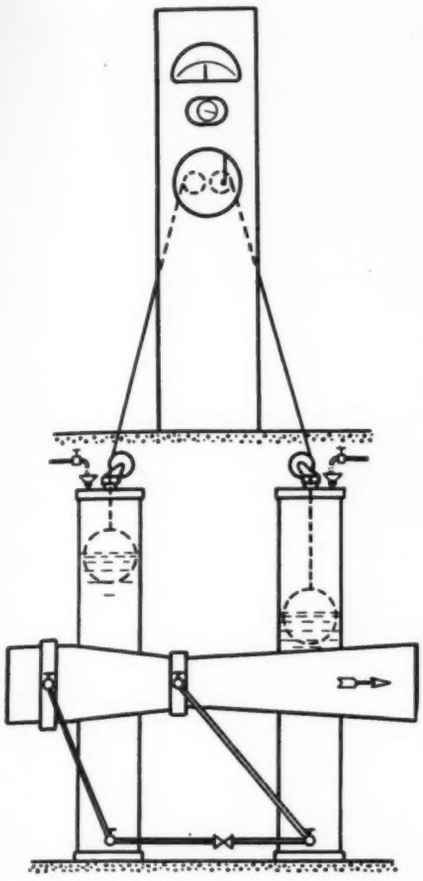



**Fig. 4—Low Head Venturi Meter**
*(Water-Column-Operated)*

turi. Its coefficient of flow, however, would be unknown; it would be valueless unless competently calibrated. In performance, however, Venturi Tubes, while of "heavy" design, are sensitive to dimensional proportions, shape of interior contour, length of throat section, roughness, and other elements.

### *The Pressure Chambers and Piezometers*

One of the several basically important features of design which Herschel found necessary in obtaining accurate results in his classic experiments, was an annular (circumferential) pressure chamber at inlet and at throat sections.

Quoting from his 1887 A. S. C. E. prize paper: "The chamber was intended to average or quiet the action of these forces, as they might act through a single orifice bored into the Venturi and directly connected with a piezometric tube. * * * I regard the use of some form of chamber as essential to the good working of a Venturi Meter."

That Herschel was on sound ground has been amply demonstrated in the experiments of later years. One might refer, for example, to the splendid series of investigation of forms and finish of piezometers made by Messrs. Allen and Hooper (Trans. A. S. M. E. 1931) whose object was "(1) to determine a stable type of piezometer suitable for use as a standard in commercial work, and (2) to determine those factors which have the greatest bearing in obtaining correct results."

A 12″ pipe line was used for the work, containing a straight "test section," with careful provision against any disturbance of flow which might affect the accuracy of the measurements. Twelve holes were drilled at regular intervals around the section, and into them were inserted brass plug "test orifices" (or piezometers) flush with the interior wall. It was necessary first, however, to prepare four "reference orifices" (or piezometers) at right angles to each other, and the experience with them is highly significant. Quoting: "As first installed, there were variations as high as 4% among the four reference piezometers. In removing these discrepancies, a great deal was learned about the action of square-edged orifices." For instance, a burr only about .001″ high, when removed, changed the readings of two orifices 0.4%; an orifice plug projecting 1/16″ beyond the interior wall produced an error of 7.4%; a slightly depressed plug surface also resulted in objectionable errors. Orifice plug faces had to be examined and corrected with the aid of a miscroscope. These investigations give an aston-

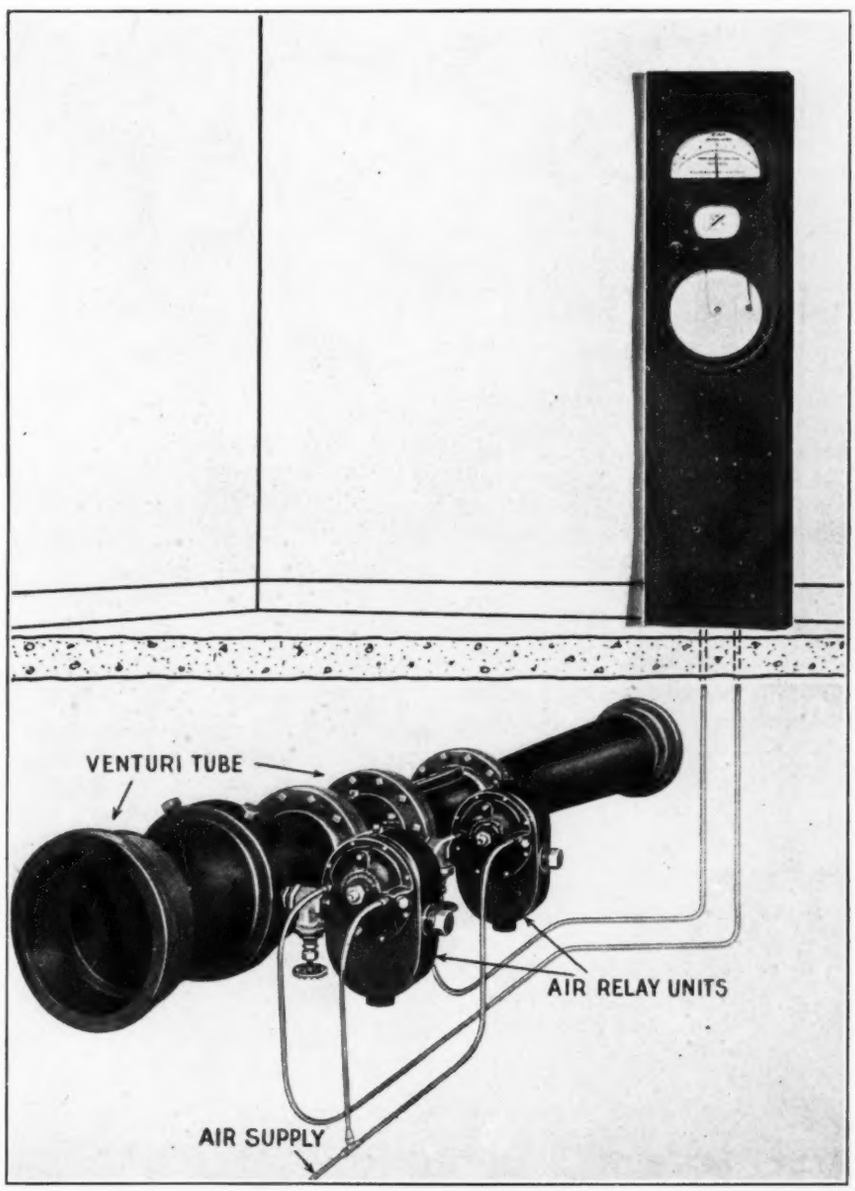



**Fig. 5—The "Air-Relay" System**
*(For details of the "air-relay" units see Fig. 6.)*

ishing insight into the errors that may arise from the use of a single piezometer opening. At last the reference orifices were brought into agreement. For the test orifices themselves, many calibrations were made under widely different conditions, comparing the results with the perfected reference piezometers. In one run, a single tubercle of tar 1¼" diameter and ¼" high in front of a test orifice caused an error of 5%. Three inches of clean and smooth pipe wall between the orifices and any roughness or tubercles were required to insure correct readings. Among their conclusions are the following important statements:

(1)—A true square-edged piezometer is accurate, but very sensitive to slight changes in construction and position.

(2)—A standard piezometer plug or plate must be absolutely flush with the conduit wall.

(3)—A piezometer that projects beyond the pipe-wall surface has a large negative error.

(4)—The burr must be carefully removed from a square-edged piezometer.

(5)—The inside penstock wall should be scraped clean for at least 1 ft. upstream from a piezometer.

Lately there has been observed some tendency by engineers for sewage plants to specify Venturi Tubes without annular pressure chambers, or at least not definitely to insist they be included. It seems doubtful that the seriousness of such omission is realized, but the references made in the preceding paragraphs emphasize how very little is needed to upset the transmission of true pressures by a single vent. Even assuming that the single orifice plug is absolutely perfect and placed with the greatest care, slime or other deposits from sewage and sludge may enter the vent hole or build up around or preceding it, with consequent disruption of accuracy.

### *As to Flat Invert Tubes*

Occasionally flat invert tubes (Fig. 2) are specified for the measurement of sewage, although at higher cost and often unnecessarily, in the author's opinion. (See "Engineering News Record" January 11 and April 12, 1934). It is obvious from the shape of these tubes that single vents at inlet and throat cannot possibly correctly transmit the true velocity heads.

Whatever the design of Venturi Tube, the errors resulting from poor approach conditions, such as elbow or bend preceding the tube, a partially closed valve upstream, etc., are aggravated if there are no annular averaging chambers.

In fairness, it must be acknowledged that in the measurement of dense sludge, it can be reasoned that experience has shown pressure chambers rather rapidly become clogged, requiring frequent flushing, so that between two evils, accuracy of measurement has at times been sacrificed by omitting the chambers. For the Columbus, Ohio, plant there was developed a hydraulic vent cleaning valve (Fig. 3) whereby the operator, with a single motion, can close and clean all the vents, as compared with the more laborious attention required for the individual manual type of cleaner.

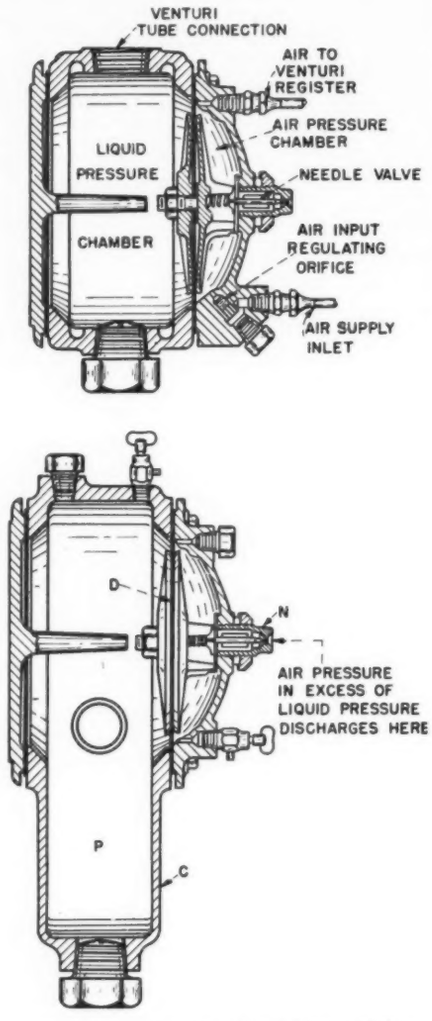



**Fig. 6—The Two "Air-Relay" Units**
*(Showing Design and Functions — see text.)*

## *Recent Developments*

Fortunately, recent developments and continued tests in the field have now made available new equipment and systems of installation which are suitable throughout the entire range from thin sewage to dense sludge. Space permits but a brief reference to major items. In general, the type of installation which is practical for the measurement of sewage is not suitable for sludge. To illustrate, Figure 4 shows a type of installation which has been very largely and successfully used for sewage. Here the inlet and throat of the Venturi Tube are connected directly to vertical pipes containing floats, which are in turn cable-connected to a differential gearing at the back of the registering instrument. An essential feature is the introduction of a small stream of clarifying water at the top of each float pipe, to create a continuous backward flow into the tube. This hook-up, however, is rarely suitable for sludge, since the relatively large displacement into and out of the float pipes causes the sludge to be "pumped" into them, with rapid settling and building up in the bottom of these pipes. If the hydraulic heads are too high to permit the use of float pipes, closed sediment chambers, set near the Venturi Tube, can be substituted for the float pipes, and connected from the top of these made to the registering instrument above. In this case, proper provision must be made for flushing and draining of the sediment tanks and connecting piping.

### *The "Air Relay" System*

The recent perfection of an "air relay" system (Fig. 5) has greatly advanced the successful metering of sludge. It is, of course, equally suitable for sewage. The two air relay units (Fig. 6), one mounted and connected to the inlet and the other to the throat of the Venturi Tube, are rather simple in construction. Each consists of a hollow chamber (C) which is divided into two compartments by a solid rubber and fabric diaphragm (D). The inner side of the diaphragm receives, directly, the liquid pressure from the interior of the Venturi Tube; the outer side receives an external air pressure, which builds up until it equals the pressure on the fluid (tube) side of the diaphragm, being continually vented through a throttled needle valve (N) attached thereto. Two small pipe lines (usually ¼" tubing) one from the inlet and the other from the throat relay unit, are connected from the outer compartment to the usual mercury wells at the back of the Venturi Register, which can be set several hundred feet distant. The air pressures transmitted by

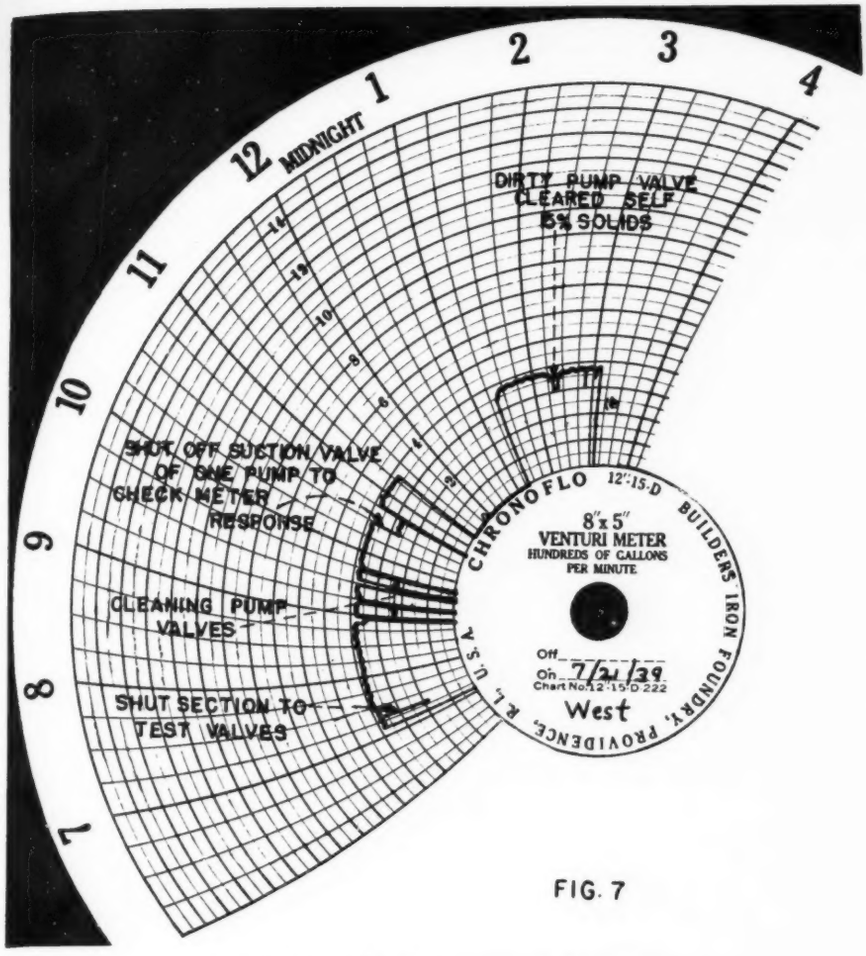


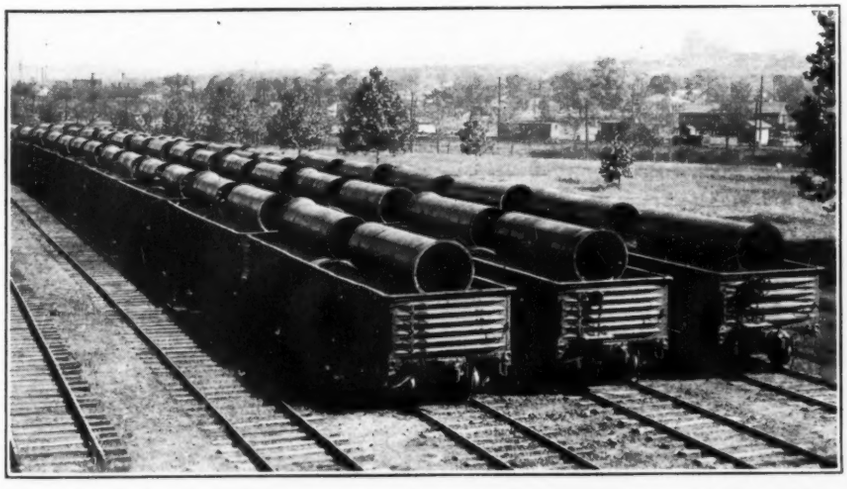

**Fig. 7—Chronoflo Chart From Sludge Meter**

*(A specimen chart from one of the sludge meters of the Minneapolis-St. Paul Treatment Works. Note the sensitive response of the meter.)*

these pipes are exactly equal, respectively, to the actual inlet and throat pressure of the Venturi Tube. The diaphragms have such a very small displacement that there is little tendency to draw sewage or sludge into the chambers. The relay units, moreover have a large capacity sediment pocket (P) with blow-off connection. Nevertheless, in the measurement of sludge, unless "thin," it is necessary that there be continuous water flushing through appropriate small sight-feed orifices. With sewage this is unnecessary, although provision for occasional flushing should be made. Attention is called to the complete separation of liquid and air by the relay unit diaphragm (D) and, hence, the impossibility of fouling of relay parts or of sewage and sludge reaching the registering instrument.

At the Minneapolis-St. Paul Treatment Works, sludge containing as high as 15% of solids is being successfully metered with Venturis having annular pressure chambers fitted with hydraulic vent cleaning valves, air relays with provision for continuous flushing, and with particular attention paid to sizes and slopes of small pressure piping. A section of the Chronoflo rate of flow chart from one of the Venturis is reproduced in Figure 7, showing the sensitive response of the meter.

The purpose of this article is to emphasize the importance of maintaining well established standards of Venturi Meters, to summarize recent advancements in their design and application for sewage plants, and to describe some of the essentials of installations which must be carefully observed if they are to be successful. It is hoped it will prove helpful to engineers and others encountering the difficult metering problems characteristic of sewage treatment processes.

**33 Miles of It**

Will be required to fill the largest order for cast-iron pipe in many years—that of Wichita, Kansas. Here is the first "Enameline Special" about ready to roll out of Birmingham for the Plains City. Incidentally, it's the first production of 48-inch Centrifugal "Enameline" pipe for any job.

# RUNOFF COEFFICIENTS BY MODEL TESTS

## Laboratory Methods Applied to Runoff Studies Are Found Useful as a Guide in the Design of Sewerage Systems

By I. GUTMANN
Editor, "Engineering Index"
NEW YORK CITY

WITHIN the past 35 years European engineers called upon to design important sewerage works made several experimental determinations of the coefficient of run-off from various shedding surfaces. In 1903 and 1904, E. Paladini and F. Fantoli in reporting on a sewerage design for Milan, Italy, presented data on precise gagings of run-off due to natural and artificial rainfall. In 1925, what was virtually an outdoor hydraulic laboratory for the determination of runoff was established at Neufahrwasser, near the Free City of Danzig. It was described by F. Reinhold in *Bautechnik* (Aug. 2 and 16, 1929). Lastly, according to a recently published paper by V. V. Lebedev, a similar but larger run-off laboratory was established in Leningrad, U. S. S. R., in 1932, where natural and artificial run-off from rainfall was observed for 3 years.

These studies, which are in fact tests of hydraulic models, are of interest not only on the score of experimental procedure and equipment, but also for the analysis of the test data in accordance with formulas expressing the coefficient of run-off for a given locality and shedding surface as a function of time only. Neither the slope and magnitude of the shedding area nor the intensity of rainfall appear in the final formulas: the frequency index of the rainfall and its duration are the only factors determining the run-off coefficient.

### *Design of Run-Off Area*

The temporary outdoor run-off laboratory at Neufahrwasser consisted principally of a gently sloping rectangular plot, about 66 ft. long by 33 ft. wide—approximately 1/20 acre in area—and a gaging chamber where the run-off from the plot was measured by means of a triangular notch weir. The plot was first covered with a stone pavement that was subsequently modified or changed as various types of surfacing were tested. The run-off from the plot was collected in a drain running along three of its borders, and was discharged into the gaging chamber shown in Fig. 1.

The sharp triangular notch weir, with a central angle of 9 deg. 32 min. was carefully calibrated in a hydraulic laboratory. The head over the notch weir was measured by means of a patented, automatically recording water level indicator. Rainfall was measured with a patented recording rain gage. There was also an automatic recording evaporimeter. Artificial rainfall was rather crudely simulated by watering the plot with a fireman's hose.

### *The Leningrad Design*

The Leningrad run-off laboratory, which operated between 1932 and 1935, had five experimental plots also measuring 66 ft. by 33 ft., surfaced with five different materials (Fig. 2). Each of the plots was provided with a gaging chamber similar to the German type. The notch weirs were of identical dimensions. Artificial rain was produced by means of a portable, multi-panel frame of 1½ in. piping, which had 204 perforations, 0.04 to 0.06 in. in diameter. The instrumental equipment was practically the same as at Neufahrwasser.

The analysis of data collected at these two laboratories must be viewed as a further development of the method originally proposed by

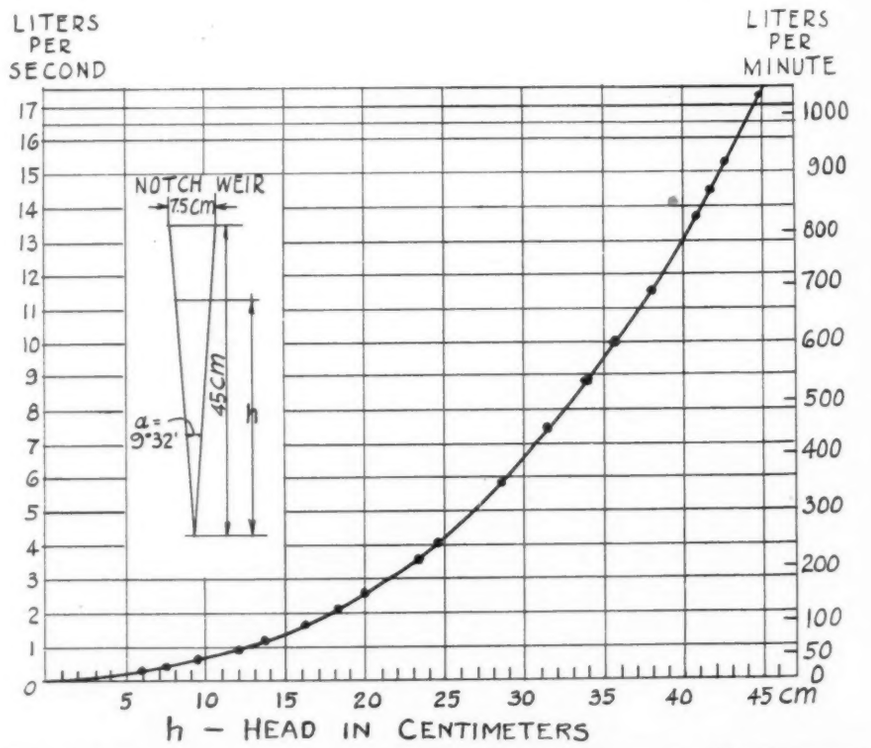



**Fig. 1.—Calibration Curve and Dimensions of Notch Weir Used at Neufahrwasser and at Leningrad**

Paladini and Fantoli of Milan at the beginning of the century. The method consisted in expressing a coefficient of run-off for a given surface as a function of the intensity of rainfall and its duration. Using symbols customary in American engineering practice, the resulting formula was:

$$C = m_F \sqrt[3]{i}\ \sqrt[3]{t} = m_F\, i^{0.333}\, t^{0.333} \quad (1)$$

Where

$c$ is the coefficient of run-off,
$i$ is the intensity of rainfall in mm. per hr.,
$t$ is the duration of rainfall in minutes, and
$m_F$ is a coefficient varying with the surface condition of the watershed.

In analyzing the data obtained at the Neufahrwasser run-off laboratory, Reinhold used the same formula but obtained different exponents for $i$ and $t$, namely

$$C = m_R\, i^{0.567}\, t^{0.228} \quad (2)$$

The coefficient $m_R$ varied from 0.0064 for a sand surface to 0.0238 for a stone paved surface. In the Reinhold formula $i$ stands for intensity of rainfall expressed as liters per second per hectare.

Lebedev, in reducing the results of the Leningrad observations, came out with a formula similar to Reinhold's but with different exponents:

$$C = m_L\, i^{0.205}\, t^{0.105} \quad (3)$$

Here again $i$ represents rainfall intensity in liters per second per hectare. With these exponents for the variables, $i$ and $t$, Lebedev obtained values of $m_L$ ranging from 0.036 for lawns to 0.250 for roofs.

Lebedev went one step further. Noting that $i$ can be expressed as $\frac{a}{t_n}$ where $a$ and $n$ are frequency and climatic indices, he substituted in his equation $\frac{a}{t_n}$ for $i$, and obtained

$$C = m_L\, a^{0.205}\, t^{0.105\,-\,0.205n} \quad (4)$$

Of course, we have had similar formulas in American engineering literature. Thus Charles Emerson Gregory, studying New York City run-off records, came out with a formula for impervious surfaces stating that $c = 0.175\ t^{1/3}$ (see *Trans.* Am. Soc. C. E., Vol. 58, 1907, p. 481). And there is also the so-called Hoad formula for impervious surfaces, $c = \frac{at}{b+t}$ (See Engineering News-Record 1919, Vol. 83, p. 870).

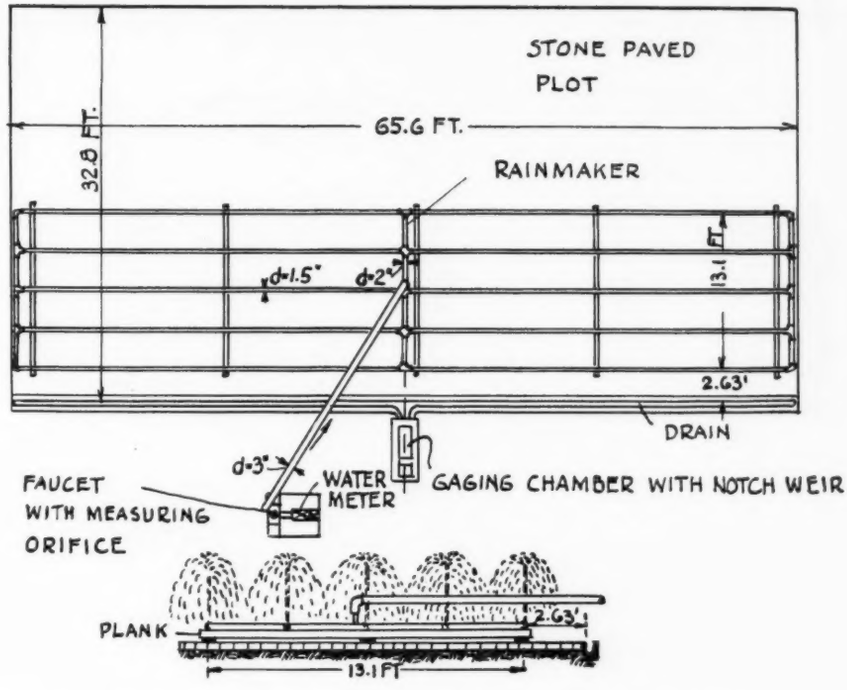



**Fig. 2.—Runoff Test Plot Used at the Leningrad Laboratory**

The Reinhold and Lebedev formulas, unlike those by McMath, Hering, Burkli-Ziegler and a good many others, entirely disregard the factors of slope, magnitude, and shape of the shedding area and involve only time units of duration and frequency—thus falling out with authoritative American studies of recent date. (See "Relation between Rainfall and Run-off from Small Urban Areas," by W. W. Horner and F. L. Flynt, in *Proc.* Am. Soc. C. E., Oct. 1934, p. 1175; also "Surface Run-off Control," by R. E. Horton in "Headwaters Control and Use"—Upstream Engineering Conference 1936, p. 29).

It should be observed that the coefficient $a$ and the exponent $n$ of the Lebedev formula conceal factors of local climate and rainfall frequency. Thus, in analyzing the Leningrad rainfall intensity records for a period of 35 years it has been found that in the formula $i = \frac{a}{t_n}$, $n$ was constant and equal to 0.64, while $a$ varied from 210 for rainfalls of the frequency of 1 in 3 months to 700 for rainfalls of the frequency of 1 in 5 years. We may say, therefore, that $n$ depends on local climatic conditions while $a$ is a rainfall frequency factor.

It may be useful to note also that the Lebedev formula (3) may be simplified without violence to read

$$C = m_L \sqrt[5]{i}\ \sqrt[10]{t}, \quad (5)$$

and that when put in British units it will read

$$C = 2.34\, m_L \sqrt[5]{i}\ \sqrt[10]{t} \quad (6)$$

where $i$ is cu. ft. per second per acre, or inches of rainfall per hr.

## *Limitation of Formulas*

It is very important to note that both the Reinhold and the Lebedev formulas, which, by the way, seem to be in fair agreement, begin to yield absurd results, namely run-off coefficients greater than 100 per cent, when $i$ approaches 4 in. per hr. and $t$ equals 10 minutes. This limitation of the formulas is not pointed out by their authors. In the United States we have many records of 10-minute rainfalls exceeding the rate of 4 in. per hr. Even the ten-year curve for New York City (not to mention the fifteen-year and twenty-year curves) exceeds these intensity-duration combinations. It simply means that, roughly speaking, these formulas are only applicable to average downpours of frequencies greater than about one in ten years. Still, being so attractively simple, they should be modified to cover a greater range of rainfall frequencies to be in agreement with American experience.

It would seem that the principal value of the studies recorded in this article is the idea of applying the

method of laboratory model testing as a guide in the design of important sewerage systems. No important spillway is designed nowadays without preliminary tests of models. Similarly, no important sewerage system should be designed without preliminary run-off tests of model plots representative of the areas to be sewered.

Moreover, the use of this method can be extended to the study of such general problems as the now disputed effect of slope and magnitude of area upon the coefficient of run-off. It would also be interesting to make similar studies of the effect of the condition of the area at the beginning of the downpour upon its shedding capacity; for it undoubtedly matters whether the ground was dry, or wet, or frozen, or wet and frozen when the storm burst upon it.

# SIMPLIFIED BOILER EFFICIENCY CHART

By W. F. SCHAPHORST, M.E.

THE accompanying chart gives the approximate efficiency of a steam boiler based solely on chimney gas temperature and heat value of the fuel. Simply run a straight line through the heat value of the fuel, column A, and the chimney gas temperature, column B, and the boiler efficiency is immediately found in column C. Thus, the dotted line drawn across this chart shows that if the heat value of the fuel is 12,000 B.t.u. and the chimney gas temperature is 600 deg. Fahr., the boiler efficiency is about 68.8 per cent. True, the result may not be "absolutely accurate" but it will certainly give a fair indication of efficiencies.

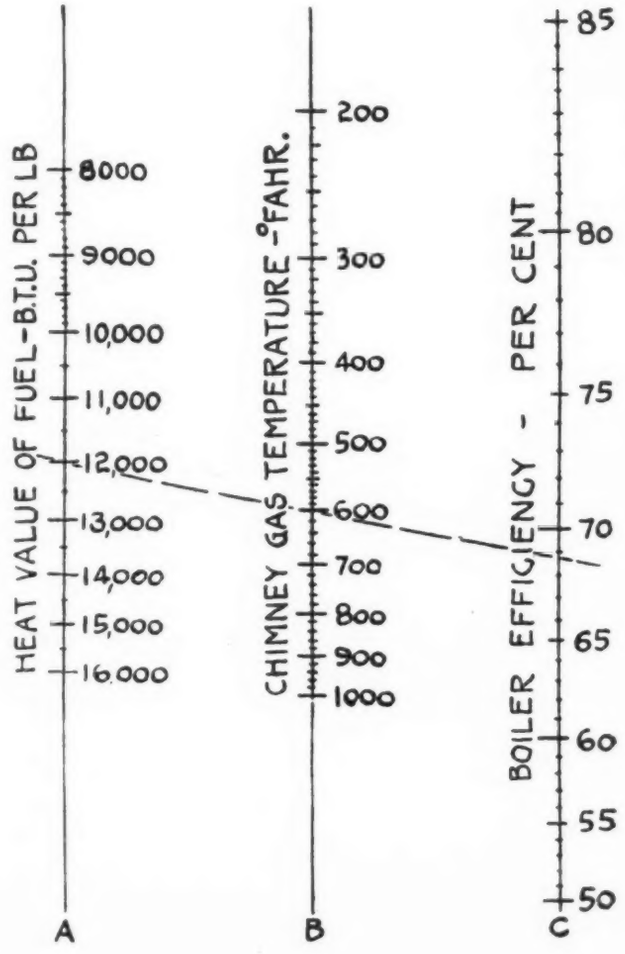
In developing this chart the writer carefully studied the averages of a number of authoritative tests where the boiler efficiencies varied from a trifle over 60 per cent to nearly 80 per cent. The heat value of the coal was considered in each case, together with the temperature of the chimney or exit gases. As a result, the following "rule" was derived: "Multiply the temperature of the exit gases in deg. F. by 625 and divide by the heat value of the fuel in B.t.u. per pound. Then subtract that from 100. The result is the approximate boiler efficiency in per cent." This will be found to be a good "rough" rule. Of course if the fire is poor, so that the gases contain a large per cent of CO, the rule naturally will not hold. The chart is based on the formula given in the rule.

### *The More Complex Procedure*

The usual but much more complex procedure in determining boiler efficiency is to "find the heat in the steam evaporated by the boiler and divide it by the heat given up by the fuel." In other words, boiler efficiency, like all other efficiencies, is equal to "output" divided by "input".

However, why bother about the steam if we know the quantity of heat that escapes through the chimney? Can't we conclude that the heat that "doesn't" escape is absorbed by the boiler? To determine the output, then, simply subtract the heat lost up the chimney from the original heat in the fuel. Divide that by the "input", or the heat in the fuel, and we have the boiler efficiency.

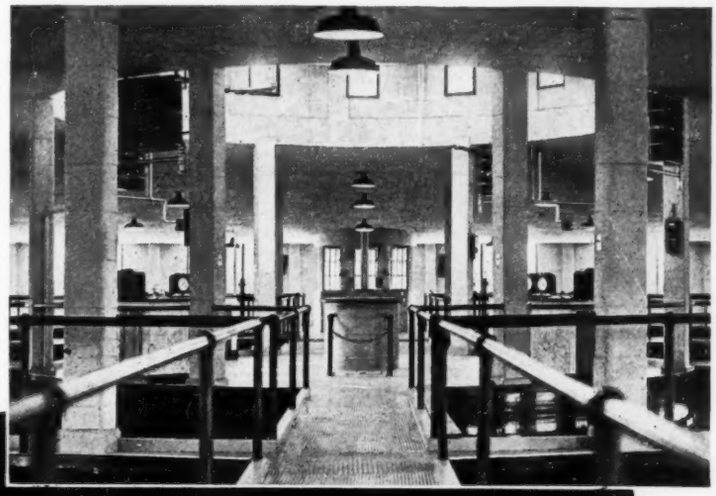
Admittedly it is not easy to find the "exact" amount of heat lost up the chimney, but it can be done with a fair degree of accuracy if one knows the number of pounds of gas passing out of the chimney in a given time. The trouble is, the quantity varies with the different fuels used and with the different firemen. A first-class fireman (with a $CO_2$ machine) can regulate the flow of air until it is "just about right". Perhaps he will use 18 pounds of air per pound of coal—perhaps more—perhaps less. Eighteen pounds is usually considered a "good" figure.




The chart will be found of further value for showing how important it is, always, to maintain as low a temperature in the chimney as possible. Thus, if you have a coal whose heat value is 12,000 B.t.u., swing a straight line about that point (column A) as a pivot. If you can reduce the temperature of the chimney gas to 500 deg. F. (100 deg.) the boiler efficiency will be found to be approximately 74 per cent, or an increase of about 5 per cent. So much coal is wasted up chimneys at the present time, in spite of all that has been said, that it is hoped a study of this chart will clearly show the seriousness of high exit gas temperature.

# The MORSE FILTER PLANT

**INDIVIDUALITY, not standardized design, is one of the greatest virtues of the Morse Filter Plant. And that individuality comes from you—the waterworks engineer. We believe you will be gratified to find how well the Morse plant will fit into your plans and to discover how convenient and economical it is to install them as complete, self-contained units. We will be glad to give you full particulars. Please address our nearest office.**

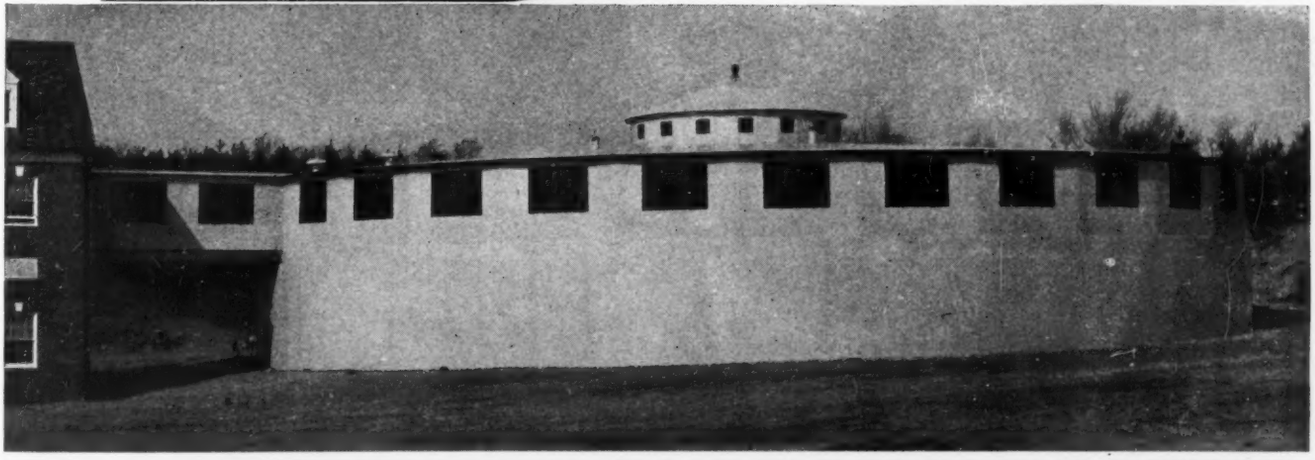


***Right: Interior view of the Morse Filter Plant at Bristol, Conn.***

## *Here's what you get:*

1. All-steel construction offers the same advantages that have proved so desirable in water storage tanks. No seepage, no cracking, less maintenance expense.
2. Requires less ground space per unit of capacity than any other type of construction. (A 5 m.g.d. unit, for example, measures only 100 ft. in diameter.)
3. Modern. Definitely designed to push obsolescence as far into the future as possible. Rapid sand type filter bed.
4. Install units as required. Put in capacity needed at present; add more capacity easily and economically at any time in the future.
5. Flexible operation. Filters and basins operate independent of each other. Rate easily increased or decreased to meet requirements.
6. Lower operating costs. Very small loss of head through plant means lower pumping cost. Cleaning and maintenance is easier and quicker.

***Below: Exterior view of the Bristol unit. It has a capacity of 5 m.g.d.***



## CHICAGO BRIDGE & IRON COMPANY

| | | | | | |
|---|---|---|---|---|---|
| Chicago | 2198 Old Colony Bldg. | Birmingham | 1586 North 50th Street | Philadelphia | 1644-1700 Walnut St. Bldg. |
| New York | 3390-165 Broadway Bldg. | Tulsa | 1646 Hunt Bldg. | Boston | 1548 Consolidated Gas Bldg. |
| Cleveland | 2262 Rockefeller Bldg. | Houston | 2919 Main Street | San Francisco | 1083 Rialto Bldg. |
| Dallas | 1479 Liberty Bank Bldg. | Detroit | 1551 Lafayette Bldg. | Los Angeles | 1455 Wm. Fox Bldg. |

*Fabricating plants in CHICAGO, BIRMINGHAM, and GREENVILLE, PA.*

# MATHIESON SANITATION SERVICE *Proves its worth* TO MODERN WILMETTE, ILLINOIS

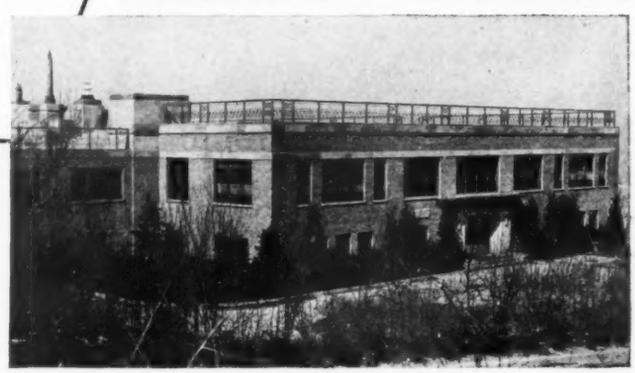
*. . . Says Gerard S. Noerenberg, Chemist, Wilmette Filtration Plant*

*"We have been users of your Chlorine for about nine years with an intermediate gap when we used another source of supply. This experience (sticky valves) fully confirmed our belief that Mathieson service is both dependable and advantageous to us. Your product has been uniformly good. There has been no trouble with sticky valves.*

*"We also use HTH in its convenient packaged form, in a number of ways. It is used as a stand-by emergency source of Chlorine in our Filtration Plant, to sterilize all new mains and reservoirs and as a health help in the prevention of Athlete's Foot in the Waterworks locker room. The public bathing beach has been using HTH for years in the showers and locker rooms. In the outlying districts, HTH is used in the sterilization of wells.*

*"Not the least of advantages in using your products has been the friendly, constant and able assistance given us by your representative, who stops in on us frequently."*

*Gerard S. Noerenberg, Chemist, Wilmette Filtration Plant.*



*Lake Michigan Filtration Plant, Wilmette, Illinois.*

● Whether the job in hand be water purification, sewage treatment or swimming pool sanitation, you have a right to expect a dependable supply of liquid chlorine—a pure product, trouble-free containers and valves, prompt delivery service. It is because Mathieson Chlorine has proved itself in these three essentials that so many communities like Wilmette, Illinois specify "Mathieson" when there is a chlorinating job to be done.

Mathieson Chlorine, coupled with HTH for special and emergency jobs that so often arise, make a team hard to beat for dependable sanitation service.

*HTH comes in 5-lb. cans with replaceable caps, packed 9 cans to the case; also in 75-lb. drums.*

## THE Mathieson Alkali Works (INC)

60 EAST 42ND STREET, NEW YORK, N. Y.

LIQUID CHLORINE . . . HTH . . . SODA ASH . . . CAUSTIC SODA . . . BLEACHING POWDER . . . BICARBONATE OF SODA . . . AMMONIA, ANHYDROUS and AQUA . . . PH-PLUS (FUSED ALKALI) . . . DRY ICE . . . CARBONIC GAS

# FREE AMMONIA IN THE PRESENCE OF CHLORAMINE

## A Proposed Test

By E. E. WOLFE, Chemist in Charge
Filtration Plant
HANNIBAL, MISSOURI

FORMERLY there existed a widespread belief that close control of the ammonia dosage in the chlorine-ammonia combination was not necessary. In recent years, with a better understanding of the reactions involved, this belief is no longer so prevalent.

Recent experiences at the writer's plant, and similar experiences by others, leads to the conclusion that serious complications may arise from ammonia dosages not under close control.

Under-dosages of ammonia may partially nullify the objectives sought for, by causing chlorinous tastes as well as rapidly dissipating the chlorine residuals. In the writer's experiences, overdosages are more to be avoided because of the danger of disastrous results through the formation of nitrites. Nitrites are annoying because of their high chlorine consuming properties and because they interfere with the ortho-tolidin test for residual chlorine when present to any great extent.

It is fairly well established that this conversion is of bacterial origin. Feben in 1935 in reporting on the presence of nitrites in the effluent of the Detroit filters, succeeded in isolating several species of nitrifiers. In summarizing his investigations, Feben says in part, "Sand filtration after ammoniation promotes the growth of these organisms, during suitable water temperatures, to a point where the chloramine process defeats its own purpose and becomes costly due to wasting of both the ammonia to feed the bacteria and chlorine to oridize their products. Their resistance makes it appear impossible or impractical to control nitrification by chlorination."

### *Hannibal Experiences*

The Mississippi river appears to be a very suitable medium for the growth of nitrifying bacteria, for this water is highly polluted, its pH is about 8.0, and in summer its temperature is ideal for bacterial propagation. While the river water almost

The Author

always carries free ammonia as is to be expected in a stream of this nature, the presence of appreciable quantities of nitrites can be demonstrated, indicating the active oxidation of this ammonia by biologic processes. In the primary settling basins the conversion goes on with vigor. In attempting to pre-chlorinate such a water, especially in the summer time, discouraging results are obtained. Frequent attempts to pre-chlorinate sufficiently to carry a residual to the filters have shown the impracticability of such a procedure, for the presence of organic matter, turbidity and nitrites will often consume as much as three parts per million of chlorine within a few minutes without leaving as much as a trace of residual chlorine. Under such conditions the addition of ammonia will, of course, preserve a part of the chlorine through the formation of chloramine, but because of the great resistance of nitrifying bacteria to chlorine compounds, these organisms will utilize any free ammonia as well as combined ammonia to form nitrites which will cause a heavy chlorine demand in the filtered water.

The filter beds particularly offer a favorable medium for nitrifiers, so that the greatest concentration of nitrites will be found, as a rule, in the filtered water prior to post chlorination.

Where storage follows filtration, as it does at Hannibal, ammonia converting organisms may grow luxuriantly, and the resulting nitrite formation will rapidly deplete the residual chlorine.

Hulbert[2], in discussing the question of nitrites and chlorine absorption, states, "In the opinion of the writer it is a practical certainty that nitrite formation will be formed, during the summer months, in nearly every water supply treated with ammonia. Once ammonia has been added, one may confidently predict its appearance at some later stage of the process where conditions most favor this form of biological activity. It may happen to be anywhere; during the passage of the water through filters, clear well, storage tanks, or distribution mains. Apparently the usual concentrations of chloramines formed in water treatment do not greatly retard, and certainly do not altogether prevent nitrification."

It is thus evident that with waters in which biological activities cause ammonia (either already existing in the supply or added in the process) to be converted to nitrites, such ammonia must be under rigid control.

### *Testing for Ammonia Content*

It appears erroneous to assume that the direct nesslerization of a water sample which had been treated with chlorine and ammonia will measure only that part of the ammonia which remains uncombined or in excess. Several investigators have reported on the unreliability of this test, each finding that the color formed in the Nessler tube represents an amount of ammonia greater than should exist as free ammonia. Frisk and Conrad,[3] in a recently published paper on a carefully controlled investigation of this question, state that "It seems to be the opinion of some investigators and workers dealing wih the subject of chloramines, that the Nessler reaction would give a quantitative test in the presence of uncombined ammonia in chloramine solution. This was somewhat doubted by the authors due to the fact that in actual practice there was found the same amount of ammonia as was added in the process." These authors conclude that chlorine

and ammonia will give residual ammonia on nesslerization when combined at a ratio below one to seven, and that it is not reliable to attempt to determine the amount of uncombined ammonia in solution of ammonia chlorine when the ratio is below one to seven.

In a private communication, Hartung of University City, Mo., stated that "the ammonia as determined by Nessler's reagent, in the water immediately preceding the chlorine application, was found to be the same as the total ammonia added prior to the process."

The writer's experiences confirm the unreliability of the Nessler test for excess ammonia. It is apparent that a method of determining the relative existence of free and combined ammonia in a water would be desirable.

### *Improved Test Developed*

Such a test, recently developed by the writer, appears to give this information with a fair degree of reliability.

McNamee[4] using as a basis the reactions according to the theories of Marckwald and Wille[5], recovers two-thirds of the ammonia in monochloramine by acidifying to a pH below 4.4 to convert to nitrogen trichloride, then nesslerizing.

Folin, in seeking a simple method for the determination of ammonia in urine, utilized the ammonia-absorbing power of a synthetic zeolite. Folin's method is widely used in medicine, and Folin's Permutit is available at all chemical supply houses.

### *Studies With Permutit*

It is apparent that if it could be shown that Folin's Permutit, which is now used in the waterworks laboratory to produce ammonia free water, will not absorb from solution the ammonia combined as chloramine, a method would be at hand to measure the combined ammonia by McNamee's method.

To determine this, there were combined in ammonia free water and at a pH slightly above 8.6, definite quantities of chlorine and ammonia so as to have a slight excess of chlorine needed to form the monochloramine. A small quantity of Folin's Permutit was added and the mixture shaken for five minutes. The water was then filtered through cotton which had been washed with ammonia free distilled water, and the ammonia determined according to the method of McNamee. In every trial made, two-thirds of the amount of ammonia added was recovered, demonstrating that Folin's Permutit had little or no effect on chloramines.

Next, a series of tests were run on artificial waters made up by adding varying amounts of chlorine and ammonia to ammonia-free water, which had been adjusted to a pH somewhat above 8.6 by the addition of sodium carbonate. After 15 minutes contact, a Nessler tube was filled and set aside for the time being. The remainder of the water was shaken with some Permutit for five minutes, and filtered into a second Nessler tube. Now both tubes were acidified and nesslerized according to McNamee, and compared with standards, reading the tubes between the first and second minutes of contact with the reagent. The results are shown in Tables 1 and 2.

In Table 2, the ammonia was held at a constant value and the chlorine was varied.

TABLE 1

| Test No. | PPM Chlorine | PPM Ammonia | Reference Tube | Permutit Tube | Excess $NH_3$ Found | Theoret. Excess | Theoret. Reading Ref. Tube |
|---|---|---|---|---|---|---|---|
| 1 | 0.5 | 1.00 | 0.95 | 0.10 | 0.85 | 0.88 | 0.96 |
| 2 | 0.5 | 0.60 | 0.55 | 0.12 | 0.43 | 0.48 | 0.56 |
| 3 | 0.5 | 0.20 | 0.16 | 0.10 | 0.06 | 0.08 | 0.16 |
| 4* | 0.5 | 0.12 | 0.08 | 0.08 | 0.00 | 0.00 | 0.08 |
| 5† | 0.5 | 0.08 | 0.05 | 0.06 | 0.00 | 0.00 | — |

*Theoretical ratio for monochloramine
† Excess chlorine

TABLE 2

| Test No. | PPM Chlorine | PPM $NH_3$ | Reference Tube | Permutit Tube | Excess $NH_3$ Found | Theoret. Excess | Theoret. Reading Ref. Tube |
|---|---|---|---|---|---|---|---|
| 1* | 1.20 | 0.20 | .12 | .16 | 0.00 | 0.00 | — |
| 2† | 0.80 | 0.20 | .14 | .14 | 0.00 | 0.00 | 0.14 |
| 2‡ | 0.40 | 0.20 | .16 | .08 | 0.08 | 0.10 | 0.17 |

*Excess chlorine
† Theoretical ratio for monochloramine
‡ Excess ammonia

### *Test Procedure*

The procedure for the above tests was as follows. In a 500 ml. erlenmeyer flask add 250 ml. of ammonia free distilled water and 0.5 ml. of sodium carbonate solution (5%). Add the requisite amount of standard ammonium chloride solution, followed by the standard chlorine solution. Let stand in the dark for 15 minutes. Transfer a portion to a 50 ml. Nessler tube. To the remainder add a few grams of Folin's Permutit and shake for five minutes. Upon subsidence, filter through a small plug of cotton previously washed several times with boiling ammonia free distilled water. Reject the first filtrate, then filter into another Nessler tube. Add 0.2 ml. of sulfuric acid (one in ten) to each tube, mix, and let stand about one minute. Add 2 ml. of Nessler reagent to each tube, mix, and compare with standards which had just previously been made. Make the comparison between the first and second minutes of contact with the reagent.

The reference tube will develop color from the excess ammonia, and from two-thirds of the combined ammonia. The Permutit tube will develop color from two-thirds of the combined ammonia only. The difference between the two tubes is the free ammonia. Should there be an excess of chlorine above the ammonia, the Permutit tube may show a higher color than the untreated tube because of extraction of ammonia from the Permutit.

For the actual application of the test to plant waters, the procedure is about the same. To 250 ml. of water add 0.5 ml. of sodium carbonate; transfer a portion to a Nessler tube, treat the remainder with Permutit for five minutes, filter through cotton and precede as above.

In plant practice, where it is desired to keep the excess ammonia at a minimum, quantitative readings may not be necessary. A visual inspection of the color differences is all that is needed. Under these conditions the reading of the tubes may be obtained a minute or so later than the two-minute interval, for the darkening of both tubes appears to progress at the same speed for a while.

Within the period during which the test has been in use at our plant, it has proved of value in holding the excess ammonia to a minimum. Also where it has been desired to use chlorine in excess to oxidize nitrites, the test been valuable.

***Summary:—***

1.—Nitrites in water disturb the chemical balance between chlorine and ammonia. This condition may be aggravated by excess ammonia added in the process.

2.—Direct nesslerization of chloramine containing waters appears to give unreliable results for free ammonia.

3.—A method is suggested for testing for free ammonia in the presence of combined ammonia.

***Refercnces***

1. Feben: "Nitrifying Bacteria in Water," J.A.W.A. Vol. 27, No. 4, April 1935.

2. Hulbert: "Chlorine and the Ortho-tolidin Test," J.A.W.W.A. Vol. 26, No. 11, Nov. 1934.

3. Frisk and Conrad: "Determining Residual Ammonia in the Presence of Chloramines," J.A.W.W.A. Vol. 31, No. 7, July, 1939.

4. McNamee: "Estimation of Chloramine in Water Supplies," Indust. and Eng. Chemistry, Anal. Edition, Vol. 7, No. 5, Sept. 15, 1935.

5. Marckwald and Wille: Ber. 56B, 1319 (1923).

# A SAFETY STIRRING DEVICE PROVES EFFECTIVE AND EASY ON GLASSWARE

By W. STROCKBINE

Chemist in Charge
Filtration Plant

READING, PENNA.

WHEN our laboratory at the new Maiden Creek Filter Plant of Reading, Pa. was equipped, a Leeds & Northrup glass electrode assembly was provided to determine pH.

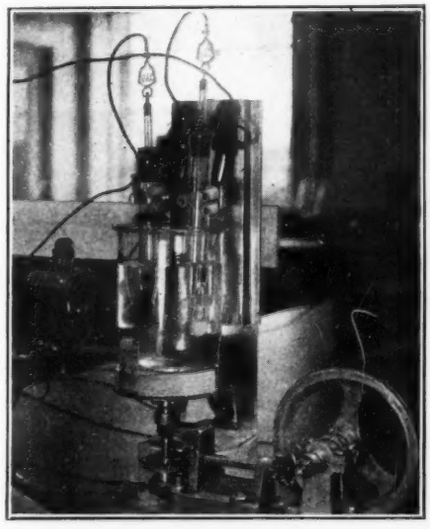
Anyone who has merely touched the bulb of a glass electrode, of the type shown in the photograph, knows that they are very fragile. To use this to titrate to a definite pH great care would have to be exercised in stirring, so that the glass electrode would not be touched. It occurred to me that the most simple and effective way to do this would be to provide a revolving base. I gave this job to our plant mechanic, who put to use some bevel gears which had been taken from an old loss of head and rate of flow indicator and assembled the revolving beaker support shown in the photograph.

An Omega laboratory stirring machine had previously been changed by us to give a wider range of speeds. This resulted in a set of five pulleys ranging from 1 inch to 3 inches being available to drive the revolving base. A speed of 90 rpm. has been found satisfactory, using a 400 ml. capacity beaker.

***Other Uses***

This apparatus can be put to use in a number of ways. We use it in our method for determining residual chlorine.

It has been found in our laboratory that the neutral starch iodide test for chlorine, as outlined on page 231 of Standard Methods, 8th edition, gives reliable results only if the pH. of the water is very close to 7.0. For instance in determining the free chlorine in distilled water the chlorine found is high because of the low pH of the distilled water, and when using this method on waters in which the pH is high, the amount of chlorine found is low. In running this test for residual chlorine, we find the amount of acid or alkali needed to bring the water to pH 7.0 by titrating 250 ml. to pH 7.0, using the apparatus shown. Four times this amount is then added to 1000 ml. of the water to be tested. From this point the titration method as outlined in Standard Methods is followed.



**Safety Stirring Device**
*(For pH determination and titrations)*

## Hand vs. Machine Methods in Sewer Maintenance

Winnetka, Illinois, reveals in the Annual Report of its Department of Public Works some interesting comparative figures on the cost of hand methods vs. machine cleaning of sewer catch basins. By the old hand method the cost was $1.28 per basin cleaned; with the machine 68.6 cents, a saving of almost half. Too bad the report did not reveal how quickly the machine would pay for itself, always an interesting aspect.

# A SALUTE TO—

## "BILL" LAWRENCE

**1885 — 1939**

***Commissioner of Water and Light***

**CLEVELAND, OHIO**

### *To you, "Bill" Lawrence, a salute!*

In winning his spurs, and rising to the top, his associates were proud of "Bill" Lawrence as Cleveland's career-man. All water works men who knew him were happy to hear of such recognition, which came of his proficiency and honesty in service, his characteristic modesty, his kindliness and consideration of those under him, a happy disposition and an ability to get along with people.

Willard Lawrence, born in Cleveland, October 9, 1885, studied civil engineering at Hiram College and was graduated in 1905. He went to work in Cleveland's Division of Water in 1907, as a 22 cent-an-hour clerk. His able experimental work on water purification won for him in 1917 the appointment as Superintendent of Filtration, which position he held until being made Commissioner of Water and Light, in October, 1938. Only a year later he was taken to a hospital, the victim of a heart ailment, which on November 15th, 1939, ended a fruitful career at its zenith. He is survived by his widow, a son and a daughter.

"Bill" Lawrence had long been prominent in water works association affairs, having served as Chairman of the Water Purification Division of A.W.W.A., and Chairman of the Ohio Conference on Water Treatment. At the time of his death he was Chairman of the Ohio Section of A.W.W.A., which last year honored him with the George W. Fuller Award "for outstanding and distinguished services and constructive leadership". He attended every convention of A.W.W.A. and every water works meeting possible. From these he got and gave much.

Concerning his attributes and his work he was modest, perhaps to a fault. One of "Bill" Lawrence's most sterling qualities, to our mind, was his pleasure to remain in "the wings" while younger men under him received the "spot light" and the recognition which, to those who knew, only reflected the magnanimity of Willard Lawrence.

In *The Cleveland Press* exactly 21 years ago, to the day of his death, Louis B. Seltzer, who has since become its editor, penned these lines—"Willard Lawrence represents all that is fine and good in public service. What public service needs most is more Willard Lawrences". And, in his editorial of November 15, 1939, Mr. Seltzer states that, "Through knowing 'Bill' Lawrence, I have learned that it is possible to be an honest and conscientious public servant, and to build a monument to yourself while living in the esteem of your associates in public service and the community at large. "Bill" Lawrence has put up a monument to himself and a mark for others in city government. They won't forget him at City Hall for a long time; maybe they won't ever forget him."

Yes—What public service needs most is more "Bill" Lawrences.

## "MAT" COLLINS

**1866 — 1939**

***Southern Manager Rensselaer Valve Co.***

**LOUISVILLE, KENTUCKY**

### *And, a Salute to you, "Mat" Collins!*

A second star fell from the skies on that fateful November 15th, when one of America's finest of characters, "Mat" Collins, left his earthly duties to younger men which he had so well picked to carry on in a territory which he had so superbly developed, and in which his personality had drawn to him a host of genuine friends and developed a confidence, which built for the company and products he represented a high regard during his thirty years of exceptional service.

Matthew Harris Collins was born in Louisville, Kentucky, in 1866. He was in the wholesale tobacco business when in 1909 he joined the Rensselaer Valve Co., and for thirteen years thereafter represented them in their Omaha territory. Seventeen years ago he came "back home" to Louisville, to become Rensselaer's Southern Manager. In October, while on a business trip he suffered a heart attack from which he never fully recovered. On November 15th he passed away in his home at the age of 73, leaving a widow and one son. (Those who knew him would hardly have judged him to be a man of these years—the accompanying picture of him being one taken at his last Southwest Water Works Convention just one year before he died.)

In the water works field we find some of the highest types of individuals amongst the so-called "peddlers". In New England "peddlers" of water works equipment who "know their stuff" are rated "Ambassadors of Commerce". To our thinking if there ever was a commercial "Ambassador", such was "Mat" Collins. He was first and always a gentleman. If it be of the "old school", then he was admired the more for it. He was temperate in all things, and that does not signify that he was "straight-laced", for "Mat" enjoyed life. What's more, he enjoyed seeing others enjoy it. He was always jovial and liked fun, so long as it was clean fun.

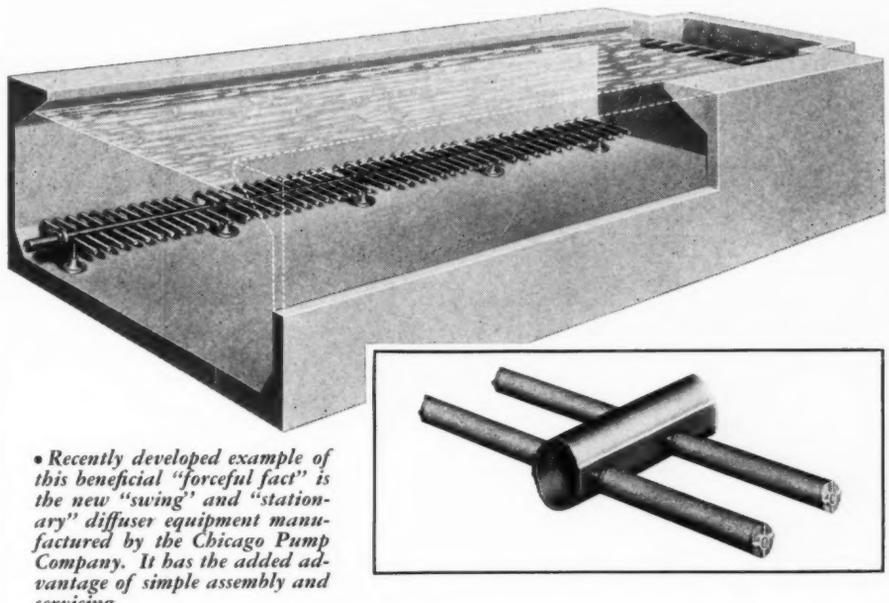
"Mat" Collins took the greatest pleasure in doing things for others. His motto seemed to be "fairness to all", and his word was as good as his bond. One of his outstanding abilities seemed to be that of judging and appraising men. He was interested in seeing credit go to him who credit is due, and he derived pleasure from helping capable and deserving men—particularly promising young men entering the sales or the operating fields. "Mat" Collins enjoyed the company and friendship of the "Aces" of the water works profession—and such was mutual.

In water works associations he took an active interest, looking to their highest service to all, and we believe he can properly be credited as one of the "Daddies" of the old Southwest Water Works Association and the Kentucky-Tennessee Section of A.W.W.A. In any case, he did much that was of benefit for both. He was a zealous Rotarian and the type of Knight Templar that made Masonry what it is.

Many of us will miss "Mat" Collins. To us a high star has gone down in the passing of an "Ambassador of Commerce"—loved by all who knew him.

*To no higher use do we consider this page could have been put.—L. H. E.*

"FORCEFUL FACTS" ON SEWAGE AERATION BY AIR DIFFUSION—No. 20



• *Recently developed example of this beneficial "forceful fact" is the new "swing" and "stationary" diffuser equipment manufactured by the Chicago Pump Company. It has the added advantage of simple assembly and servicing.*

# WIDE DISTRIBUTION OF AIR BUBBLE DIFFUSION GIVES MOST EFFICIENT AERATION

MOST engineers agree that *the greatest amount of oxygenation in activated sludge treatment is derived from air bubble diffusion.* This is a principle long proved and accepted. Correlated is forceful fact No. 20, that by distributing the bubbles in a wide band, more efficient oxygenation is obtained.

Initial small bubble size is retained due to minimized coalescence. A greater contact area of air bubbles per unit volume of air results, which in turn means more oxygen absorption. Also, smaller bubbles rise more slowly so that added benefit is derived from longer contact. A further advantage is that a wide band of diffusion will assure better mixing and eliminate the possibility of an unaerated "center core".

Obviously, to secure the greatest benefit from the application of this principle, it is advisable to start with the smallest possible bubbles that can be economically produced. For a given permeability or pressure loss rating, Aloxite Brand Diffusers will deliver smaller bubbles than any other type of diffuser.

POROUS CARBORUNDUM PRODUCTS

**THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.**

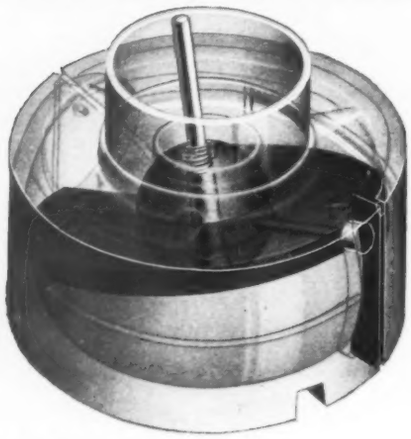
REG. U. S. PAT. OFF.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Aloxite are registered trade-marks of The Carborundum Company)

# EQUIPMENT NEWS

## Trident Meter Improvements



● Neptune Meter Company announces that on January 1st, a thrust roller bearing plate will become standard in the disc chambers of Trident water meters. Its purpose is to prolong the life of the chamber, to *increase* its *sensitivity*, to reduce the cost of repairs, and to eliminate a possible source of sound which, under certain conditions, might be amplified to an objectionable degree.

That it will do all these things has been proved in a number of years of actual service under varying conditions in all parts of the country.

In these improved chambers, the thrust roller will run against this inexpensive renewable bearing plate, so that the resultant wear will no longer be taken by the chamber itself. This results in more years of service and reduces the cost of obtaining meters from the repair shop which produce a better test record.

Of further interest to present users of Trident Meters is the fact that the new chambers may be installed in meters already in service and, if it is so desired, old chambers may be returned to the factory to be brought up to date.

Details and descriptive literature may be had from Neptune Meter Co., 50 W. 50th St., New York City.

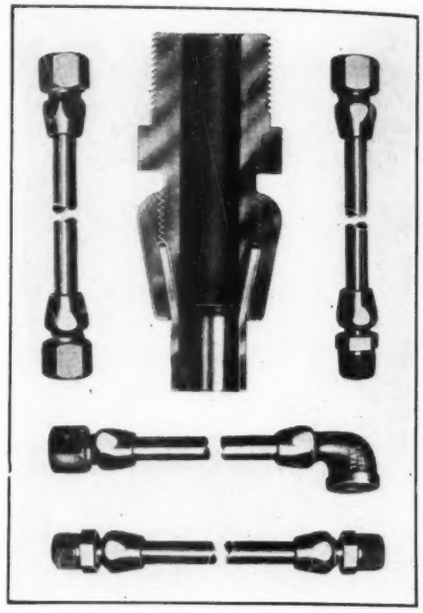
## "Shatter-Proof" Water Mains

● This descriptive and intriguing term has been coined by Hill, Hubbell & Co. of Cleveland, producers and applicators of protective coatings and wrappings for pipe lines. The term indicates a main of Hill-Hubbell protected steel pipes, jointed with flexible couplings of the Dresser type, and tapped by corporation cocks of the new "compression type" developed by Mueller Co.

For descriptive literature, listing recent main installations of "Shatter Proof" construction, write Hill, Hubbell & Co. Division, General Paint Corp., Cleveland, Ohio.

## Superseal Connectors

● "Superseal" Connectors are made and sold by the Superseal Corporation, New York City, for use with aluminum, brass, copper and steel tubing, etc. These connectors are available in sizes ⅛ in. to 2 in. in various adaptations (see photograph) and a wide range of lengths.



The particular effectiveness of this type of connector is due to the distinctive design of the "Superseal" Couplings, employing the exclusive compression joint, sealed both inside and outside with the ends of the tubing flared to a 20 degree angle. This provides a long flare which makes certain an absolutely tight seal with the tubing wedged between the self-aligning compression nut and the fitting. The cut-away view clearly shows this long flare. Leaks or breaks are impossible.

With "Superseal" Connectors the sealed flare can be loosened and tightened any number of times without injury to the tubing. Another feature is the full inside diameter of both tubing and fittings.

For literature, write Superseal Corp., 300 4th Ave., New York City.

## Improved Laboratory Pencils

● The Chemical Rubber Co. of Cleveland announce an improved Laboratory Pencil now available in four colors, Red, Blue, Yellow, Black.

The specially compounded "one stroke" lead makes a dense, distinct, durable mark even on the highest glazed surfaces. Its markings do not run at temperatures up to 300° Centigrade and hold their color in the presence of all ordinary reagents. The paper casing, with patented string attachment, makes sharpening easy and eliminates waste. The price is attractive.

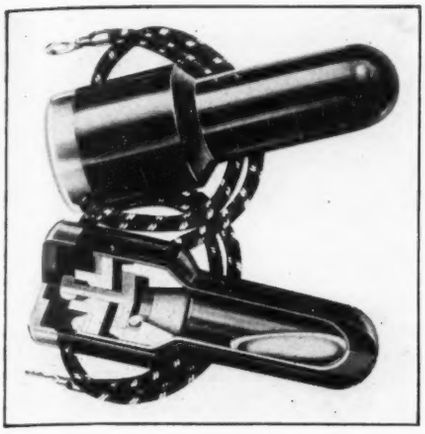
For further information concerning No. 9382-A Laboratory Pencil, write The Chemical Rubber Company, Cleveland, O.

Wishing
All Our Friends
A Very
Merry Christmas

"Everybody likes Activated Alum"

Activated Alum Corp.
CURTIS BAY, BALTIMORE, MD.

## Novel Safety Mercury Switch



The Durakool Mercury Switch

● Those concerned with electrical switches for points of explosion and fire hazard will find the Durakool Metal Mercury Switch of considerable interest.

Durakool, Inc., Elkhart, Ind., is offering a silent, unbreakable and non-sparking mercury switch, in which the new Double Reduction principle (two reducing agents) prevents deterioration of the mercury, eliminates possibility of contact interruptions, increases efficiency and reliability in operation.

"Durakools," reported to be the only commercial mercury switch available above 40 ampere capacity, have capacities up to 200 amperes and operate on small tilt with remarkably little energy. These units are recommended for many new applications, from wall switches to motor starters. Due to the steel shell enclosure they appear to offer absolute safety in any explosive atmosphere, and with a rubber covering may even be used under water or other liquids. They carry a three-year guarantee.

For descriptive literature and prices, write Durakool, Elkhardt, Indiana.

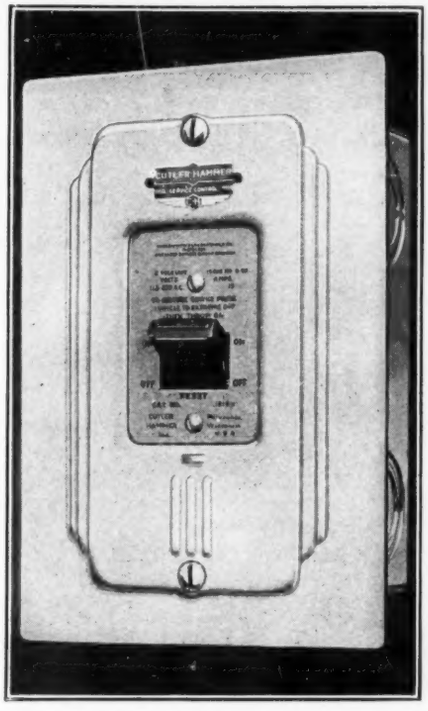
## Improved Pipe Vise

● This improved RIGID "Tri-Stand Vise" has three legs for greatest stability and balance. The legs are fitted for screwing to a floor or plank if desired; they are hinged at the tray and fold compactly together. There is a pipe rest and three sizes of pipe benders that will not collapse the tube or pipe. The vise has "No-Mar" jaws which do not damage pipe or tube surfaces.

For descriptive literature, write Ridge Tool Company, Elyria, Ohio.

## Cutler-Hammer Multi-Breakers

● Employing a "Multi-Breaker" Service Control inconveniences of fuse "blow outs" are things of the past. This because Multi-Breakers require only the resetting of a small lever—conveniently located—to restore service without bother or fuss. Now, Cutler-Hammer, Inc., announces a further Multi-Breaker development, the small size, type MO Multi-Breaker rated from 15 to 25 amperes.



Designed for use in the home, shop plant, or commercial building, the new inexpensive MO Multi-Breaker functions as an entrance or service switch, with overload and short circuit protection on lighting circuits, oil burners, stokers, and water heaters, refrigerating units, etc., brefly it can be installed wherever fused switches are employed.

For further details write Cutler-Hammer, Inc., Milwaukee, Wis.

## New Chemical Feed Pump

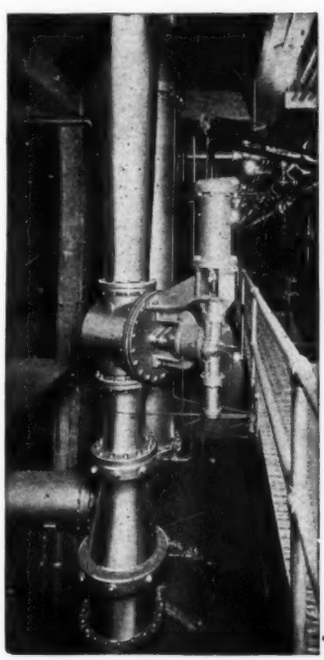
● D. W. Haering & Co. of Chicago announces the development and introduction of the new Nelson Chemical Proportioning Pump, for which they have been appointed National Distributors.

The Nelson Pump, a trim piston displacement unit, is applicable to the treatment of water, sewage, sludge, internal boiler treatment, corrosion control, etc., and may be also applied in continuous sampling. In connection with reciprocating pumps it becomes automatic in proportioning dosage of chemical to flow, through "synchronized" drive.

A new folder describing the Nelson Pump may be had from D. W. Haering & Co., Inc., 2308 S. Winchester Ave., Chicago, Ill.


*Which Primary Element?*

**VENTURI TUBE, FLUME, WEIR, ORIFICE, OR NOZZLE**



**The primary element for your metering application should be selected not arbitrarily but by the requirements to be fulfilled and by the economic considerations entering into the installation.**

**Sewage and sludge are often, though not always, measured by Venturi Tubes, Flumes, or Weirs.**

**Water may be satisfactorily measured by any type of primary element. Factors such as the cost of pumping, the pressure and the size of pipe or channel usually dictate the device used.**

**Steam is usually measured by the Bailey Orifice or Flow Nozzle.**

**Bailey Meter Company holds no brief for any particular primary element, its only interest is in making sure that the user secures the highest accuracy and reliability at the lowest expense.**

***Detailed information on the advantages of various types of primary elements furnished on request.***

MU-18

**BAILEY METER COMPANY**

**1072 IVANHOE RD., CLEVELAND, O.**

**Bailey Meter Company Limited, Montreal, Canada**

FERRIC ISCO CHLORIDE

For Sewage and Water Treatment have you tried

• ISCO •

Ferric Chloride . . . . .
SOLUTION or CRYSTAL?

FOR SLUDGE CONDITIONING—Ferric Chloride is accepted as the agent most efficient from the standpoint of performance and cost.

FOR COAGULATING SEWAGE—Ferric Chloride provides an inexpensive and effective method of dealing with plant overloads.

FOR WATER PURIFICATION—Ferric Chloride is an economical and practical coagulant, and gives quick-forming, fast-setting floc. Write

INNIS, SPEIDEN & CO.
117 LIBERTY STREET, NEW YORK, N. Y.
Chicago Cleveland Boston
Philadelphia Gloversville, N. Y.

SO YOU'RE GOING TO ST. LOUIS! STAY AT
Hotel Lennox
IT'S RIGHT DOWNTOWN, GOOD PARKING... AND MAN, WHAT SERVICE!
ALL ROOMS WITH BATH—RADIO RECEPTION

**POSITION WANTED**

**By Chemist**—Operating water or sewage treatment plant or selling water works and sewerage chemicals or equipment. B.S. and M.S. in chemistry. Four and one-half years' experience as Sanitary Chemist in State Health Department. Address "D. J. J.," % Water Works & Sewerage, 155 East 44th St., New York City.

**By Engineer**—Const. Supt.; Graduate Civil Engineer, 20 years' experience in designing, estimating, sewage disposal, water and power supply, roads and industrial plants. Available immediately.—Address—"H. A. P.," care Water Works & Sewerage, 155 E. 44th St., New York City.

**Water Works Engineer:** Member A.S.C.E.; Registered Professional Engineer in Pennsylvania and West Virginia; over 25 years experience on construction, design and plant management; extensive valuation experience with utilities and Public Service Commission. Now available for position; any location or capacity. Address W. H. C., Water Works & Sewerage, 330 So. Wells St., Chicago, Ill.

## Excavator That Does Multi-Duties

● Low, overhanging wires directly above the trench presented pipe installation difficulties in this instance of pipe laying. The contractor had been using a P&H Model 255 crawler mounted excavator on this project; and, although this excavator is fully convertible for seven types of service as crane, clamshell, skimmer scoop, trench-hoe, pile driver, etc., it proved impractical to employ the regular crane boom because of its length.

To meet this situation, the contractor removed the dipper sticks and dipper attachment and used the stripped shovel boom

as a crane to lift and lower the pipe into place. Following this, a clamshell bucket was used with the same boom for cleaning up operations. Thus is illustrated the versatility of the modern highspeed excavator.

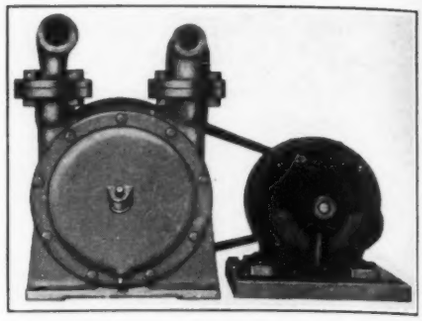
The P&H Model 255 excavator used here is one of the newest. It is equipped with tractor-type crawlers, and built of new alloy steels, all welded throughout, for greater strength, less weight and greater mobility.

For further details write, "P&H", Milwaukee, Wisc.

## A Unique Pump For Corrosive Liquids

● An interesting new pump has been recently introduced by Huber Pump Company, New York City. This unit, designed to handle corrosive and abrasive liquids, employs an entirely new principle of operation. In it, vacuum first sucks the liquid into flexible tubing, then pressure forces it out on the discharge side.

A flexible tubing in the pump (rubber or neoprene as dictated by the liquid being handled) is confined within the casing (on left in picture), which prevents the tubing from expanding beyond its normal diameter and length, even under high pressures. Vacuum created by the action of the pump draws liquid into the tubing. Then, this liquid is literally squeezed out of the tubing by pressure applied progressively from the intake to the discharge end. The pressure on the tubing (the squeezing) is accomplished by an eccentric rotor revolving within a circular com-

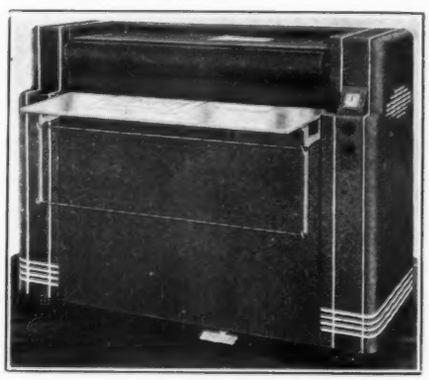


pressor ring. This ring is so adjusted that it completely closes the tubing which is forced against it by the progressive action of the rotor. The tubing has a heavy elastic wall construction which enables it to spring back to its original form immediately after the rotor releases it, thereby creating a high vacuum on the suction side while a high pressure is being built up on the discharge side.

No stuffing box of any kind is required, because the liquid being pumped is kept within the tube during its passage through the pump and the tubing is held in position on the suction and discharge ends by special tube retainers. This type of pump does not require any valves on the suction side to help maintain the vacuum as it is a positive, self-priming unit—an instant vacuum being created by the sudden expansion of the empty tube.

For further details concerning this novel inner-tube pump address Huber Pump Co., 90 West St., New York City.

## New Blue Print Machine Features High Speed Mercury Arc



● A completely new type of blue print machine, embodying as a major improvement the use of the new Hanovia high pressure mercury quartz lamp, is being produced by the Charles Bruning Company, Inc.

In view of tests showing that this new light source overcomes the disadvantages inherent to carbon arcs, the Bruning announcement points out that the new Hanovia high-pressure mercury quartz lamp should not be confused with the ordinary low pressure mercury tube used in slow-speed blue printers. The guaranteed life of the Hanovia lamp is at least 1,000 hours, without any appreciable diminution of light volume in the period. The current consumption of the new mercury

printed is only 1/3 that of a carbon arc machine of equal capacity. In addition to the Hanovia lamp, the new Bruning machines will embody many mechanical innovations in safety, improved feeding, speed control, drive, elimination of tracing slippage and wear. Easier, faster, and more economical operation and improved printing results.

Test runs on a model of the new Bruning Mercury Blue Print Machine have been made at a speed of 20 feet per minute from new pencil and ink tracings using medium speed blue print paper.

For details and price, write the Chas. Bruning Co., Inc., 100 Reade St., New York City.

# WITH THE MANUFACTURERS

## Franklin Institute Honors Johns Manville Head

**Donor and Medalist**
*W. M. Vermilye* *Lewis H. Brown*

● To Lewis H. Brown, President of the Johns Manville Corporation, was recently awarded the coveted Vermilye Medal of The Franklin Institute.

Mr. Brown was chosen for this award in recognition of his "outstanding contributions in the field of industrial management."

In his speech of acceptance, Mr. Brown defined the scientific manager and business leader of tomorrow as "he who can plan ahead with the vision of the engineer—be as receptive to advances in technical knowledge as the researcher in his laboratory—prove as keen a student of human nature as a psychologist—have an attitude as impartial as that of a judge—and show a keen sense of social responsibility."

Those who have read the many printed speeches of Mr. Brown, including his acceptance speech, are best equipped to appreciate those qualities which have won for him the deserved recognition and all that the Vermilye Medal signifies.

## K. E. Meneke Joins Lancaster Iron Works

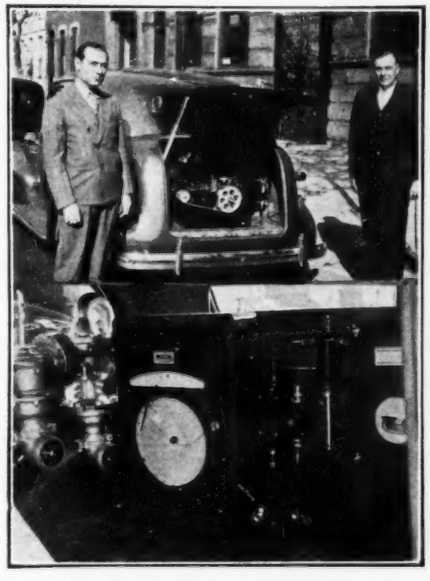
● K. E. Meneke has resigned his position with Filtration Engineers Inc., to join the staff of the Lancaster Research Laboratories of Hackensack, N. J. (Division of Lancaster Iron Works, Inc.), in the capacity of Sales Engineer.

In his new position, Mr. Meneke will represent the Lancaster Research Laboratories in the expansion of their engineering services to industrial plants, in the study and solution of industrial waste problems. In this endeavor he will push sales of the new "package delivery" milk waste treatment unit offered to the dairy industry.

## Northrop & Co. to Sell Marlow Pumps

Marlow Pumps announces the appointment of Northrop & Co., Inc., 50 Church Street, New York, N. Y., as exclusive distributors for their line of pumps to water and sewer departments and water companies throughout the country. Marlow manufactures a complete line of self-priming centrifugal, diaphragm and sludge pumps and are the pioneers in the portable centrifugal pump field. These pumps are made in sizes from 1½ in. to 10 in. and are equipped with dependable 4 cycle engines.

## "Wood's Wonder Wagon"



**A Show Room on Wheels**

● For "%Proportioneers%" show room on wheels was chosen the euphonious name "Treatment Trailer." So, the show room on wheels which Alan Wood of Philadelphia has equipped for covering his territory for Builders Iron Foundry and "%Proportioneers%" Inc., we would call "Wood's Wonder Wagon." This, not alone because of what it contains but because we *wonder* how he even contrived to get so much equipment in it and still have elbow room for steering.

"Wood's Wonder Wagon" (see cuts) contains operating exhibits of Proportioneer's chemical feeders, hypochlorinators and ammoniators; and, Builders' registering, indicating and recording apparatus for Venturi meters, and "this and that"—some of which appears in the lower view of the interior of the car.


**LESS WORRY *with* WATER MAINS**

**Tegul-MINERALEAD Jointing Compound offers advantages found in no other such compound.**

1 TIGHT, FLEXIBLE Joints that will not blow out under any pressure the pipe itself will stand.

2 QUICK HEALING—to meet at once any reasonable specification as to leakage. Trenches can be backfilled and premises cleared up without delay.

3 10 lb. INGOT FORM—Convenient to handle, store and ship.

4 IMPERVIOUS TO RAIN, Snow and Flood. A 20,000 lb. stock of Tegul - MINERALEAD, submerged for days, went to work the moment the water receded.

5 CORRECTLY MIXED AT PLANT—cannot change composition under jolting in transit.

6 NO SKILLED LABOR required. No caulking or deep bell holes.

A Tegul PRODUCT

Expect trouble-free jointing with Tegul-MINERALEAD, You won't be disappointed. For literature on How to Save Time and Money in Pipe Jointing, write The ATLAS MINERAL Products Company of Pa., Mertztown, Pennsylvania.

Tegul- MINERALEAD

**For Jointing Bell and Spigot Pipe**

**FREE**

**A six day trial of an OK Sewer Cleaning Machine**

**Consider: We would be out of business long ago if the OK Sewer Cleaner did not sell itself under this offer for we have been merchandising one equipment under this plan for many years.**

**Under this plan you BUY—no high pressure salesmen at your elbow to force decision—the machine must meet the rigid requirements of your needs. And you *make the decision.***

**You have nothing to loose—a favorable decision to accept the trial offer may save money, time and will assure service satisfaction.**

**Write today for Blueprint.**

**CHAMPION CORPORATION**
**4714 SHEFFIELD AVENUE**
**HAMMOND, IND.**

# Accuracy

SIMPLEX

**The primary requirement of any metering device is its ability to accurately record and totalize flow rates over a wide range and with prompt response to any change in rate.**

**Only when all characteristics of both primary and secondary devices are known and properly related can this be done.**

**Purchasers of Simplex Venturi Tubes and Meters receive, in addition to mere equipment, the results of over 35 years continued studies and research on both the primary device and the meter register. With this knowledge incorporated in the equipment design, accuracies of any Simplex installation satisfy the most demanding requirements of designing and operating engineers.**

**Let Simplex Engineers show you WHY and HOW you can benefit.**

SIMPLEX
VALVE & METER
COMPANY

**6743 UPLAND STREET • PHILADELPHIA, PA.**


# MEETINGS SCHEDULED

Dec. 21—Boston, Mass. (Hotel Statler)
**New England Water Works Ass'n.** Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Dec. 28—New York, N. Y. (Commodore Hotel)
**New York Section A.W.W.A.** (Winter Meeting) Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

Jan. 17-19, 1940—New York City, N. Y. (Engineering Societies Building)
**American Society Civil Engineers.** Annual Meeting. Secretary, George T. Seabury, 33 West 39th St., New York City.
(Jan. 19—Sessions and Joint Dinner of the Sanitary Engineering Division and N. Y. State Sewage Works Ass'n.)

Jan. 19-20—New York City, N. Y. (Hotel McAlpin)
**New York State Sewage Works Ass'n.** Sec'y, A. S. Bedell, State Board of Health, Albany, N. Y.
(Jan. 19—Joint Annual Dinner with San. Eng. Div. of A.S.C.E.)
(Jan. 20—Joint inspection trip with San. Eng. Div. of A.S.C.E.)

Jan. 18—Boston, Mass. (Statler Hotel)
**New England Water Works Ass'n.** Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Jan.—Stillwater. Okla. (A. & M. College)
**Oklahoma Water and Sewage Conference.** Annual Meeting. Secretary H. J. Darcey, State Dept. of Health, Oklahoma City, Okla.

Feb. 19-23—College Station, Texas (A. & M. College)
**Texas Water Works & Sewage Short School.** Secretary, V. M. Ehlers, State Dept. of Health, Austin, Tex.

Mar. 4-8—Detroit, Mich.
**American Society of Testing Materials.** Sec.-Treas., C. L. Warwick, 260 So. Broad Street, Philadelphia, Pa.

Mar. 18-20—Birmingham, Ala (Thomas Jefferson Hotel)
**Southeastern Section A.W.W.A.** Sec.-Treas., B. P. Rice, Room 425, State Office Bldg., Columbia, S. C.

Mar. 20-22—Trenton, N. J .(Hotel Stacey Trent)
**New Jersey Sewage Works Association,** (Silver Anniversary). Sec.-Treas., Paul Molitor, Jr., P. O. Box 374, Morristown, N. J.

Mar. 27-29—(Place not selected)
**Canadian Section A.W.W.A.** Secretary, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

*Apr. 4-5—West Lafayette, Ind. (Purdue University)
**Indiana Section A.W.W.A.** Secretary, H. G. Horstman, 603 Traction Bldg., Indianapolis, Ind.

Apr. 5-6—
**Montana Section A.W.W.A.** Secretary, H. B. Foote, State Board of Health, Helena, Mont.

Apr. 8-10—Lexington, Ky.
**Kentucky-Tennessee Section A.W.W.A.** Secretary, H. D. Schmidt, State Dept. of Health, Nashville, Tenn.

Apr. 21-25—Kansas City, Mo. (Headquarters Hotels—The Phillips, The President and The Muehlebach)
**American Water Works Association** Annual Convention. Secretary, Harry E. Jordan, 22 East 40th St., New York City, N. Y.

May 8—Portland, Ore. (Portland Hotel)
**Pacific Northwest Sewage Works Ass'n.** (Annual Meeting) Sec.-Treas. Fred Merryfield, Oregon State College, Corvallis.

May 9-10—Akron, Ohio
**Ohio Section A.W.W.A.** Secretary, T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

May 9-11—Portland, Ore. (Portland Hotel)
**Pacific Northwest Section A.W.W.A.** Secretary, Fred Merryfield, Oregon State College, Corvallis, Oregon.

May 16-18—(Place not selected)
**Florida Section A.W.W.A.** Secretary, A. P. Black, University of Florida, Gainesville, Fla.

* Note: Change in dates.

May 22-24—CHICAGO, ILL. (Congress Hotel)
**Illinois Section A.W.W.A.** Secretary, H. E. Hudson, Jr., 6843 Oglesby Ave., Chicago, Ill.

June 6-7—ITHACA, N. Y. (Hotel Ithaca)
**New York Section A.W.W.A.** (Spring Meeting). Secretary, R. K. Blanchard, 50 West 50th St., New York, N. Y.

June 24-28—ATLANTIC CITY, N. J.
**American Society of Testing Materials** (Annual Meeting). Sec.-Treas., C. L. Warwick, 260 So. Broad St., Philadelphia, Pa.

June 24-26—STATE COLLEGE, PA. (Nittany Lion Inn & Dormitories)
**Pennsylvania Water Works Operators' Association.** Annual Convention. Sec.-Treas., I. M. Glace, Consulting Engineer, 22 So. 22nd St., Harrisburg, Pa.

June 26-28—STATE COLLEGE, PA. (Nittany Lion Inn & Dormitories)
**Pennsylvania Sewage Works Association.** Sec.-Treas., L. D. Matter, Distr. Engr., Kirby Health Center, Wilkes Barre, Pa.

# CATALOGS AND LITERATURE

**New A.S.T.M. Standards** have been announced in a four-page prospectus from the American Society of Testing Materials. Constituting a new departure, the Society is to issue its tri-ennial Book of Standards (heretofore issued in two parts) and its 1938 Book of Tentative Standards (issued every alternate year) combined under single covers. However, to render the combination more wieldy, three books will be required. Part I "Metals; Part II "Non-Metallic Materials—Constructional"; Part III "Non-Metallic Materials—General". The four-page folder which carries this announcement, lists all sections of each volume. The complete set of three bound volumes, which should be ready before Jany. 1st, will sell for $22.00; any two for $15.00; any single volume $8.00. For a copy of this prospectus write A.S.T.M., 260 South Broad St., Philadelphia, Pa.

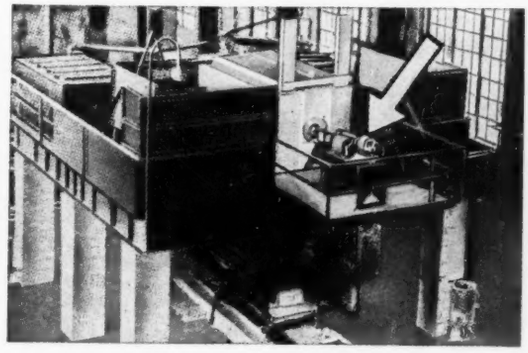
**Worthington's Newest** development in deep well turbine pumps features the "Vacuum Molded Impeller" produced in extreme density and uniformity of texture, resulting in toughness and smoothness to give long wear and high efficiency to these novel semi-enclosed impellers. The patented molding process involves die filling by slow suction (vacuum) applied to draw the purest molten metal from beneath the surface *up* into the die. The alloy [89% copper, 10% aluminum and 1% iron] is stronger than steel and has a Brinnell hardness of 130, to withstand sand and corrosivity of waters. The important details of construction are illustrated in bulletins (H-450—B29) and (H-450—B30), which should interest every pump user, or prospective user. Address, Worthington Pump and Machinery Corp., Harrison, N. J.

**Hersey Meters**—Are described and pictured externally and internally in a new edition of Hersey Meter Catalog just out. Each of the many models of disc, current, compound, detector (by-pass and check types) and proportional meters are presented in individual folders bound into the flat opening ring bound catalog. Also presented are Hersey Portable Test Meters, Hot Water Meters, Hersey Strainers and Meter Connections. Specifications are given and the distinctive features of each model of meter are emphasized, along with performance and accuracy curves for the detector and compound meters. For a copy of the new Hersey Meter Catalog write Hersey Mfg. Co., South Boston, Mass.

(Continued)


WHY TAKE CHANCES
when the HILL-HUBBELL "Factory Applied" PROCESS takes the HAZARDS out of LINING—COATING-and-WRAPPING

**The several factors that imperil a Lining and Coating-and-Wrapping job are ELIMINATED by the HILL-HUBBELL "factory applied" Process. (1) All work is done INDOORS under ideal weather conditions. (2) The felt wrapper, coating and kraft paper are applied MECHANICALLY without the risk of faulty work due to careless or inexperienced workers. (3) With automatic temperature control coating is of the PROPER temperature the INSTANT it is applied. It is important that STEEL PIPE be properly Lined and Coated-and-Wrapped—the HILL-HUBBELL "factory applied" Process eliminates entirely the hazards that cause inferior work. WHY TAKE CHANCES?**



**Arrow points to Mechanical Agitator that never fails. Automatic temperature control prevents destructive overheating. All our equipment is permanently installed INDOORS.**

GET OUR STORY

**The Book of PIPE PROTECTION describes in detail how STEEL PIPE is MECHANICALLY Lined and Coated-and-Wrapped at the Mills under ideal conditions. Use your letterhead and write for a copy.**

GENERAL PAINT CORPORATION
HILL, HUBBELL & CO. • Division • Cleveland, Ohio
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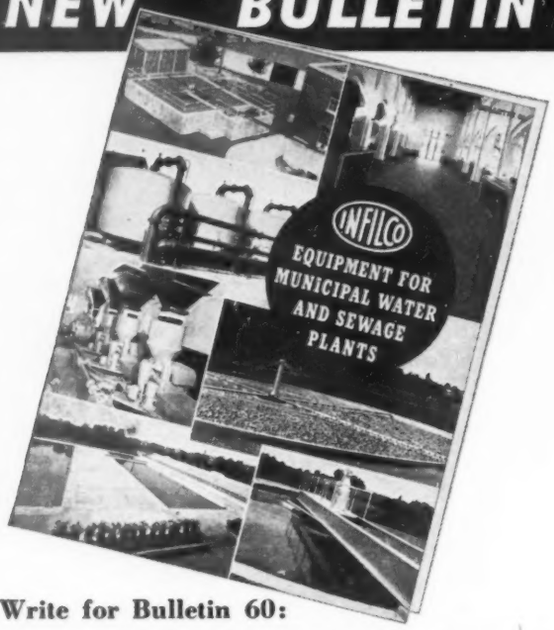
NEW BULLETIN

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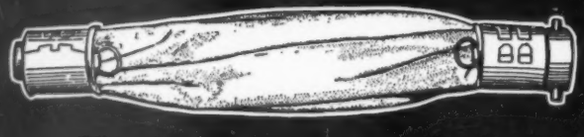

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**Walworth Ni-Resist Pipe,** is the subject of a new bulletin issued by Walworth Company, New York. It describes the medium-priced, corrosion and heat resistant cast iron pipe recommended for services such as laboratory waste lines, chemical solution lines and "hot spots". A tabular comparison of corrosion resistance for Ni-Resist, as against unalloyed cast iron, gives the corrosion rate when the pipe is subjected to various corrosives at different concentrations. This corrosion chart is accompanied by an interesting photographic comparison showing the corrosive effect on two samples after one week's submersion in 5% sulphuric acid at room temperature. Chemical properties of Ni-Resist pipe are listed, together with general applications. The bulletin also describes valves and fittings available in Ni-Resist. For a copy write Walworth Company, 60 East 42nd St., New York City.

**"R-C Turbine Pumps"** are presented in a bulletin from the Turbine Pump Division of Roots-Connersville Blower Corporation. Such units are being more generally employed in water and sewage treatment wherein boosting of pressure of a small volume for injector operation is advantageous, also where high pressure may be desired for cleaning operations; and, in boiler plants, as condensate return units. The new bulletin covers design features in detail, wherein a cutaway illustration of a typical R-C Turbine proves very helpful to the reader. Amongst the featured elements of design is found the rotating internal seals which eliminate need for the troublesome conventional stuffing boxes, and preclude possible shaft leakage. The impeller with V-shaped vanes (peripheral teeth) is responsible for the excellent performance curves, a specimen of which is exhibited. Self-priming ability is one advantage and the economy of power use, inherent with the positive displacement turbine type pump, is another advantage over centrifugal type units where there is variable head duty. For a copy of "R-C Turbine Pumps" write Roots-Connerville Corp., Connersville, Indiana.

**"Heat Exchangers and Pressure Vessels"** are presented in a new illustrated bulletin from the Alco Products Division of American Locomotive Co. Amongst the Heat Exchangers, of interest to sewerage engineers, are the Exhaust Gas Water Heaters and Steam Generation Boilers now increasingly employed in connection with sludge gas utilization and rubbish and garbage incineration. For a copy of "Pressure and Heat Exchangers" write Alco Products Div., American Locomotive Co., 30 Church St., New York City.

**"Ozone and Palatability"**—is a brochure from Ozone Processes, Inc., which presents the historical background of ozone and the ozonation process in water purification. Thereafter it discusses 1939 ozonation as it has been improved and developed by Ozone Processes, Inc., recently. Good illustrated descriptions of the unit producing the Ozonated air—the "Ozonator"—and the 18-ft. deep unit for diffusing and dissolving the ozone—the "Ozonizer"—cover each in some detail.

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**INFILCO'S Condensed Catalog**—is something of a review of the many units of water works and sewerage equipment supplied by International Filter Com-

pany. A brief description of each device is for the most part illustrated. Few, we believe, know that International offers a "GRIDUCTOR" which is a coarse screen and cutting mechanism for converting coarse sewage solids into settleable particles. This and 24 better known INFILCO devices are covered in the four pages. For a copy of Bulletin 60 write International Filter Co., 325 W. 25th Place, Chicago.

**"Pipe Lines"**—is the caption of the first issue of a publication by the new Clay Sewer Pipe Association, Inc. We believe the clay-pipe propaganda would be more effective and valuable if the features of clay pipe were emphasized more and data useful to engineers presented; and, the "horrible examples" of what happens to competitive pipe did not constitute about 90% of the context of the publication. Apparenly "Pipe Lines" is to be issued monthly and we hope later to be able to comment more favorably on its context. The address of the Clay Sewer Pipe Association, Inc., is The Oliver Bldg., Pittsburgh, Pa.

**"The Art of Proportioning"**—comes from D. W. Haering and Co. as the second printing of their earlier booklet, of the same name, which describes the application of the Haering Fluid Piston Principle to liquid proportioning problems. This twenty-four page catalog is profusely illustrated with installation photographs of proportioning equipment and diagrams of various models and types of feeders. The use of pitot tubes and hydraulic principles involved in proportioning are described and explained. Proportioning units for handling all types of reagents, including lime slurries and hypochlorite solutions, are listed. For a copy write D. W. Haering & Company, Inc., 2308 S. Winchester Ave., Chicago.

(Also, Haering is distributing the new 3rd Edition of their treatise on "Organic Methods of Scale and Corrosion Control," in which theories and principles are explained in simple language.)

**Hobart's Handbook**—contains up to date information on Hobart Electrodes, Electrode Holders, Welding Shields, Protective Clothing, Welding, Ground and Power Cables and Miscellaneous Welding Accessories. For a copy write Hobart Bros., Troy, Ohio.

**Spray Painting Catalog**—A new 1940 Catalog and Data Book on spray painting and finishing equipment comes from Binks Manufacturing Co., of Chicago. Consisting of 104 factual and highly illustrated pages, the catalog is designed for ready reference purposes. It gives the answers to everyday finishing problems, reports new developments in spray painting equipment, gives prices, and provides engineering and performance data on all types of spray guns, spray booths, air compressors, painting outfits, extractors, respirators, and hose. For a copy of Catalog No. 75 write Binks Mfg. Co., 3114-40 Caroll Ave., Chicago.


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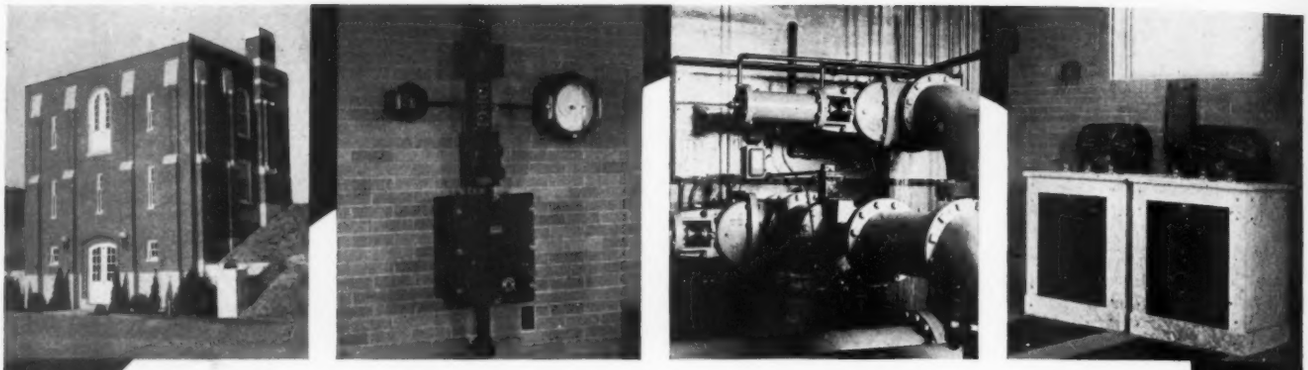

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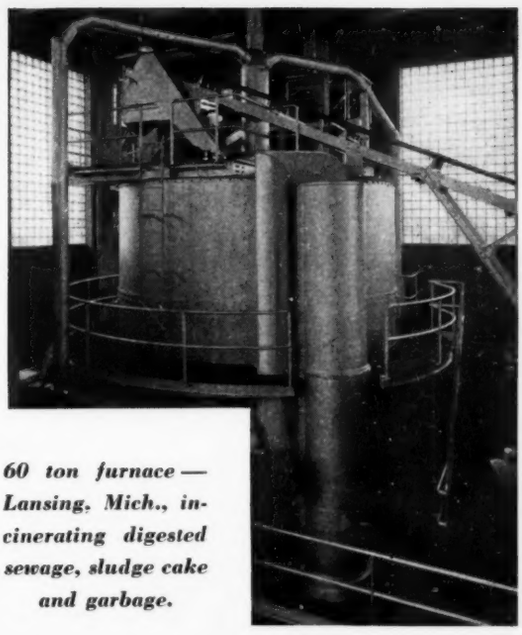

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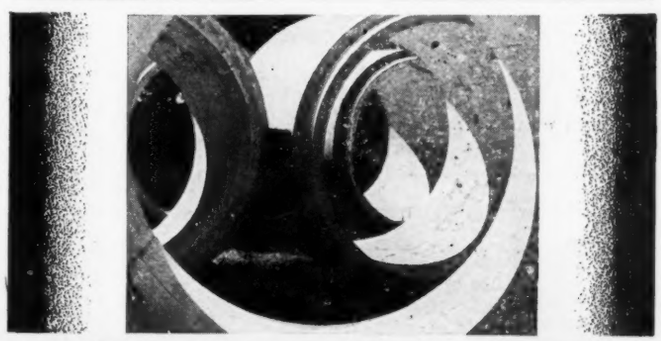

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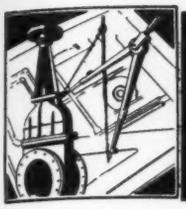

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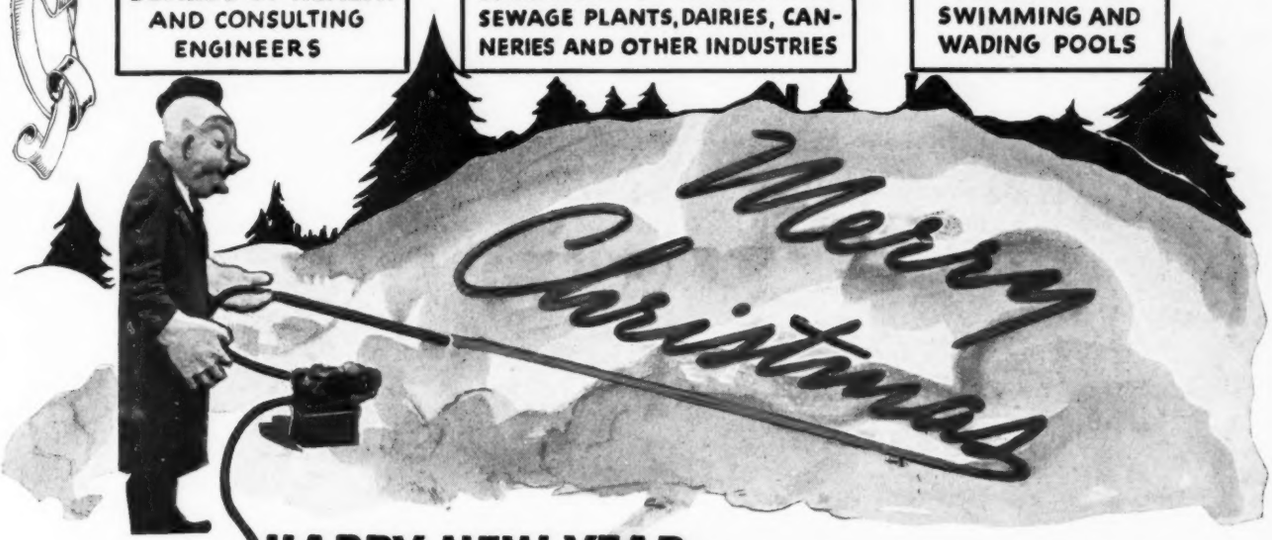


(AND A HAPPY NEW YEAR IF I HAVE ENOUGH LEFT)

WE THANK YOU FOR KEEPING US AND OUR FACTORY AND THE TREATMENT TRAILER SO BUSY THAT WE HAVE BECOME "CHEMICAL-FEEDER HEADQUARTERS"

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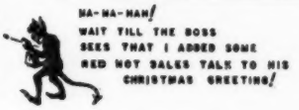


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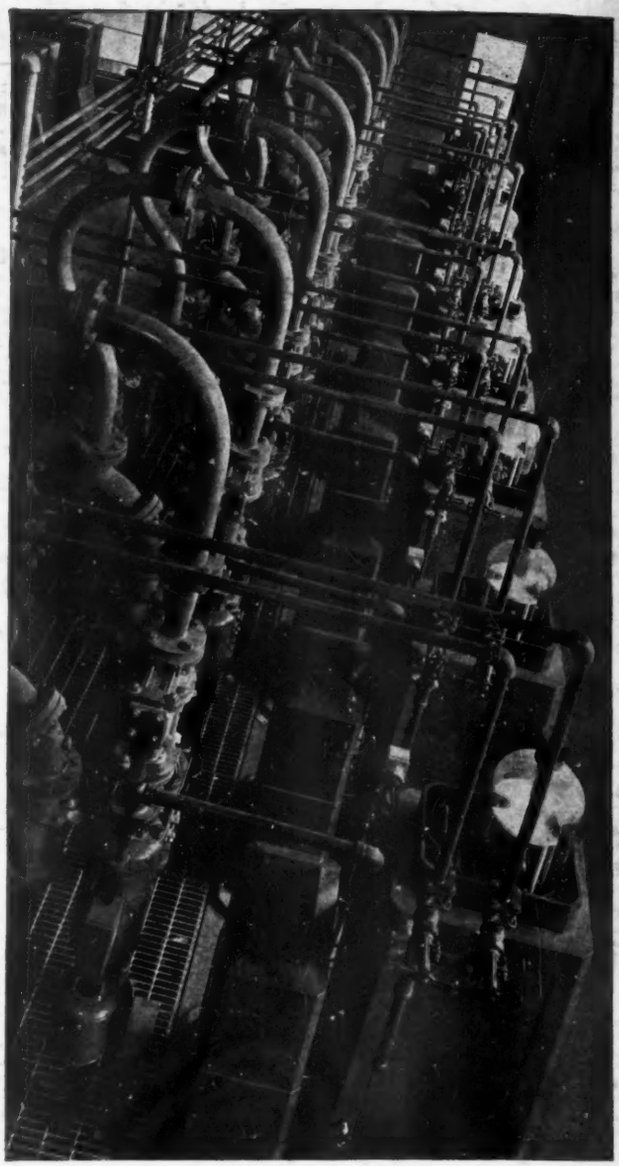

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